Final
Archaeological Inventory Survey Report
For the City Center (Construction Section 4) of the
Honolulu High-Capacity Transit Corridor Project,
Kalihi, Kapālama, Honolulu, and Waikīkī Ahupua'a,
Honolulu (Kona) District, Island of O'ahu
TMK: [1] 1-2, 1-5, 1-7, 2-1, 2-3 (Various Plats and Parcels)

Volume VIB

GPR Results:

Zone 7 Kaka'ako West (Test Excavations 116 to 161)

Zone 8 Kewalo Test Excavations 162 to 178)

Zone 9 Kaka'ako East (Test Excavations 179 to 197)

Zone 10 Kālia (Test Excavations 198 to 225)

Zone 11 Kaka'ako Makai (Test Excavations 226 to 232A)

Prepared for

The City and County of Honolulu

and

The Federal Transit Administration

On Behalf of

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1.1 Overall Location

For reporting purposes for this AIS, the City Center Section 4 of the HHCTCP has been divided into 11 zones based on geographical and cultural boundaries. The West Kaka‘ako Geographic Zone runs along Halekauwila Street from Richards Street on the west end to and into Ward Avenue on the east end (Figure 1). The West Kaka‘ako Zone is located within Honolulu Ahupua‘a.

The West Kaka‘ako Geographic Zone includes 46 AIS test excavations, T-116 through T-161 (note: T-135 was abandoned). Test excavation numbering proceeds from northwest to southeast. The test excavations were located within TMKs [1] 2-1-014, -026, -030 (Halekauwila Street; owned by the City and County of Honolulu); [1] 2-1-026 (area *mauka* of Halekauwila Street; owned by the State of Hawai‘i); [1] 2-1-031:002 (column location; owned by Dora Aoyagi); [1] 2-1-030:043 (column location; owned by the Bishop Estate); [1] 2-1-030:001 (section of *makai* portion of Civic Center Station; owned by the Bishop Estate); [1] 2-1-050:067 (*makai* utility relocation areas owned by the Hawaii Community Development Authority); and [1] 2-1-052:022 and :027 and [1] 2-1-050:001 and :062 (*mauka* and *makai* utility relocation areas owned by Victoria Ward, Ltd.).

1.2 Geography, Geology, and Land Forms

The West Kaka‘ako Zone is situated along the low-lying coastal flats immediately inland of Honolulu Harbor generally within one kilom of the shoreline. The historic shoreline was further inland, and the western-most portion of the West Kaka‘ako Zone (around T-116 and T-117) would have been offshore. This area lacks streams. Pauoa Stream was displaced to the west by the post-erosional Punchbowl Crater (Pūowaina) to join Nu‘uanu Stream. The two intermittent streams in Makiki Ahupua‘a, Kanaha and Makiki Streams, were also displaced by this Pūowaina tuff cone with Makiki Stream forced east into Mānoa Ahupua‘a and Kanaha Stream meandering and dissipating through the marshy Makiki coastal lands (see Vol. II Figure 54). Elevation along the West Kaka‘ako portion of the transit corridor range from approximately 1.2 to 1.9 m amsl with a slight rise in elevation to the west. The West Kaka‘ako Zone receives between 663 and 691 mm (26 to 28 inches) of annual rainfall (Giambelluca et al. 2011). As the area traverses a predominantly urban landscape, vegetation consists primarily of introduced (non-indigenous) landscaping trees, shrubs, and ground cover.

According to the U.S. Department of Agriculture Soil Survey Geographic (SSURGO) Database (2001) and soils survey data gathered by Foote et al. (1972), sediment types within West Kaka‘ako primarily consist of Fill Land (FL) with ‘Ewa Silty Clay Loam (EmA) within the central portion of the zone, surrounding the Civic Center Station location (Figure 1). Fill Land is described as:

> …areas filled with material dredged from the ocean or hauled from nearby areas, garbage, and general material from other sources... This land type is used for urban development including airports, housing areas, and industrial facilities [Foote et al. 1972:31].

‘Ewa Silty Clay Loam soils are described as:

> …well-drained soils in basins and on alluvial fans… [that] developed in alluvium derived from basic igneous rock... These soils are used for sugarcane, truck crops, and pasture. The natural vegetation consists of fingergrass, kiawe, koa haole, klu, and uhaloa. [Foote et al. 1972:29].

1.3 Modern Land Use and Built Environment

The West Kaka‘ako Zone traverses an urban environment through the neighborhood of Kaka‘ako. The centerline of the project alignment within the West Kaka‘ako Zone lies within Halekauwila Street. Parcels bordering Halekauwila Street contain largely commercial structures, some warehouses, parking lots, some multi-story residential structures, and Mother Waldron Park, with many roads, alleyways, and driveways extending out from Halekauwila Street. Portions of Halekauwila Street itself have been lined with cut basalt curbstones. A massive utility corridor is also present throughout the West Kaka‘ako Zone containing electrical, gas, water, sewer, and storm lines. The number and distribution of these existing utilities indicates that this West Kaka‘ako portion of Halekauwila has been heavily disturbed in the past.

1.4 GPR Sediment Summary

Test excavations in the West Kaka‘ako Geographic Zone (Zone 7) revealed that the area was predominantly Fill Lands (FL) as predicted by the U.S.G.S Soil survey map of the zone (Figure 1) Naturally deposited sediments encountered in this zone were generally too deep for the GPR to clearly read. The average depth of clean signal return for this area was approximately one m. Test Excavations that contained naturally deposited sediments within the GPR clean signal range are included in Table 1. Naturally deposited sediments within the range of clean GPR signal return for Zone 7. Representative signal texture profiles for Zone 7 are shown in Figure 2, Figure 3, and Figure 4. Signal texture profiles were only collected if the signal return was clear and the stratum was at least 0.25 m thick.

Table 1. Naturally deposited sediments within the range of clean GPR signal return for Zone 7

ZONE 7-WEST KAKAAKO (T-116 TO T-161)			
TEST EXCAVATION	STRATUM	MATERIAL	STRATUM ORIGIN (mbs)
119A	II	sandy loam	0.4
120	II	loamy sand	0.6
151	IIB	sand	0.8
151	IIC	sandy clay	1.25
157	II	sand	0.8
157	III	loamy sand	1.2

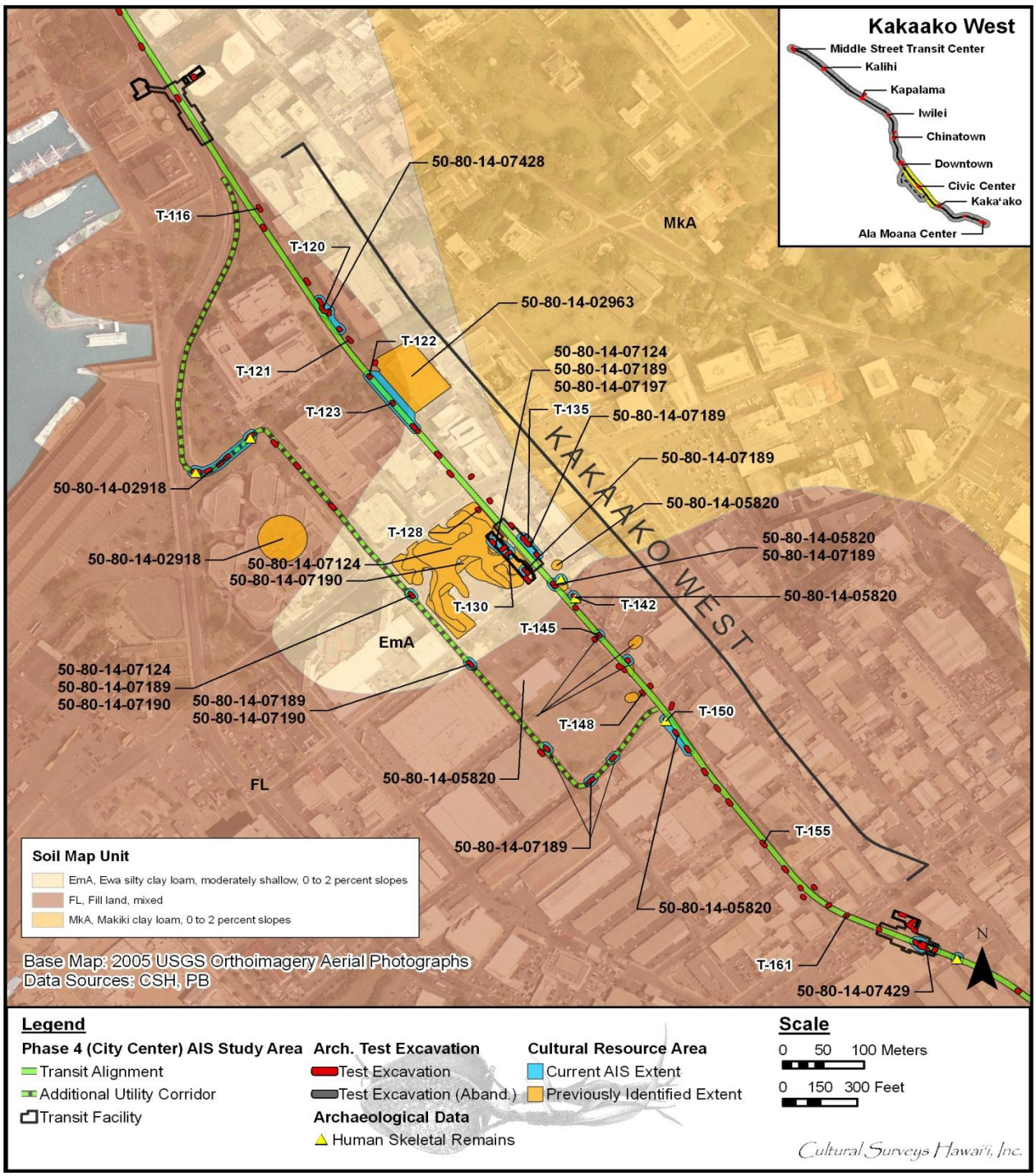

Figure 1. Aerial photograph (source: U.S. Geological Survey Orthoimagery 2005) with overlay of the Soil Survey of Hawai‘i (Foote et al. 1972) showing sediment types within and in the vicinity of the West Kaka'ako Zone

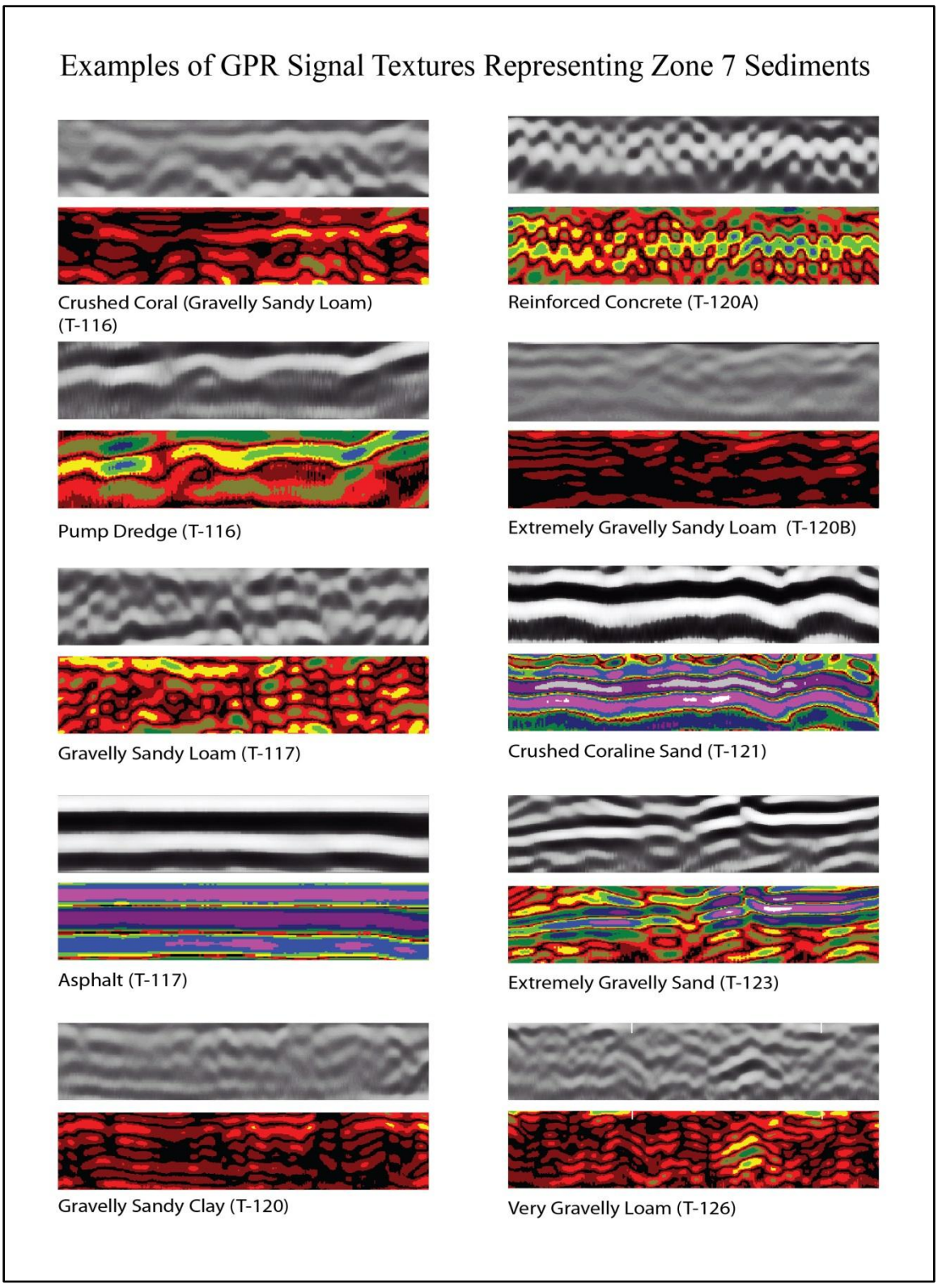

Figure 2. Examples of GPR signal textures representing Zone 7 sediments

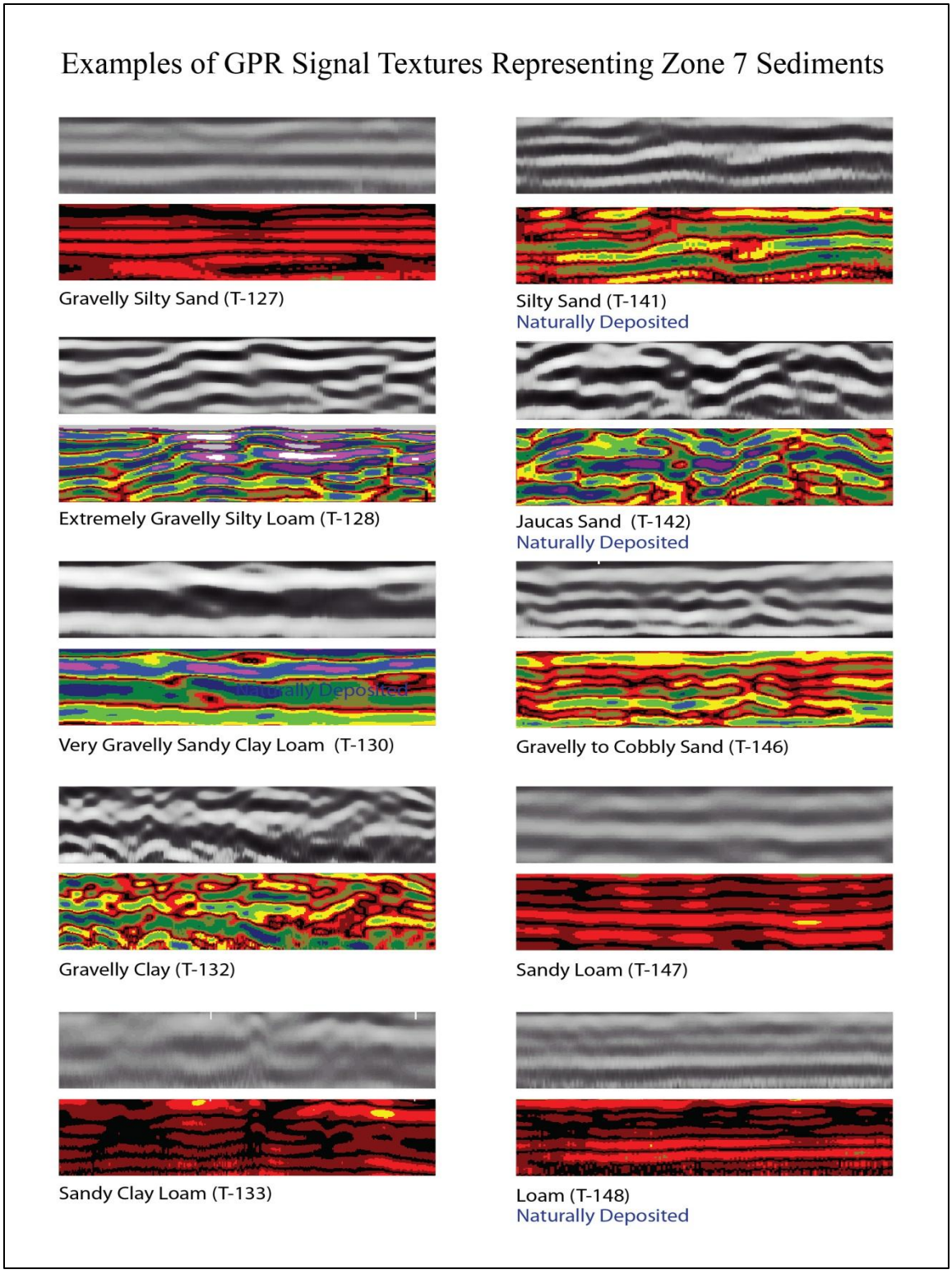

Figure 3. Examples of GPR signal textures representing Zone 7 sediments

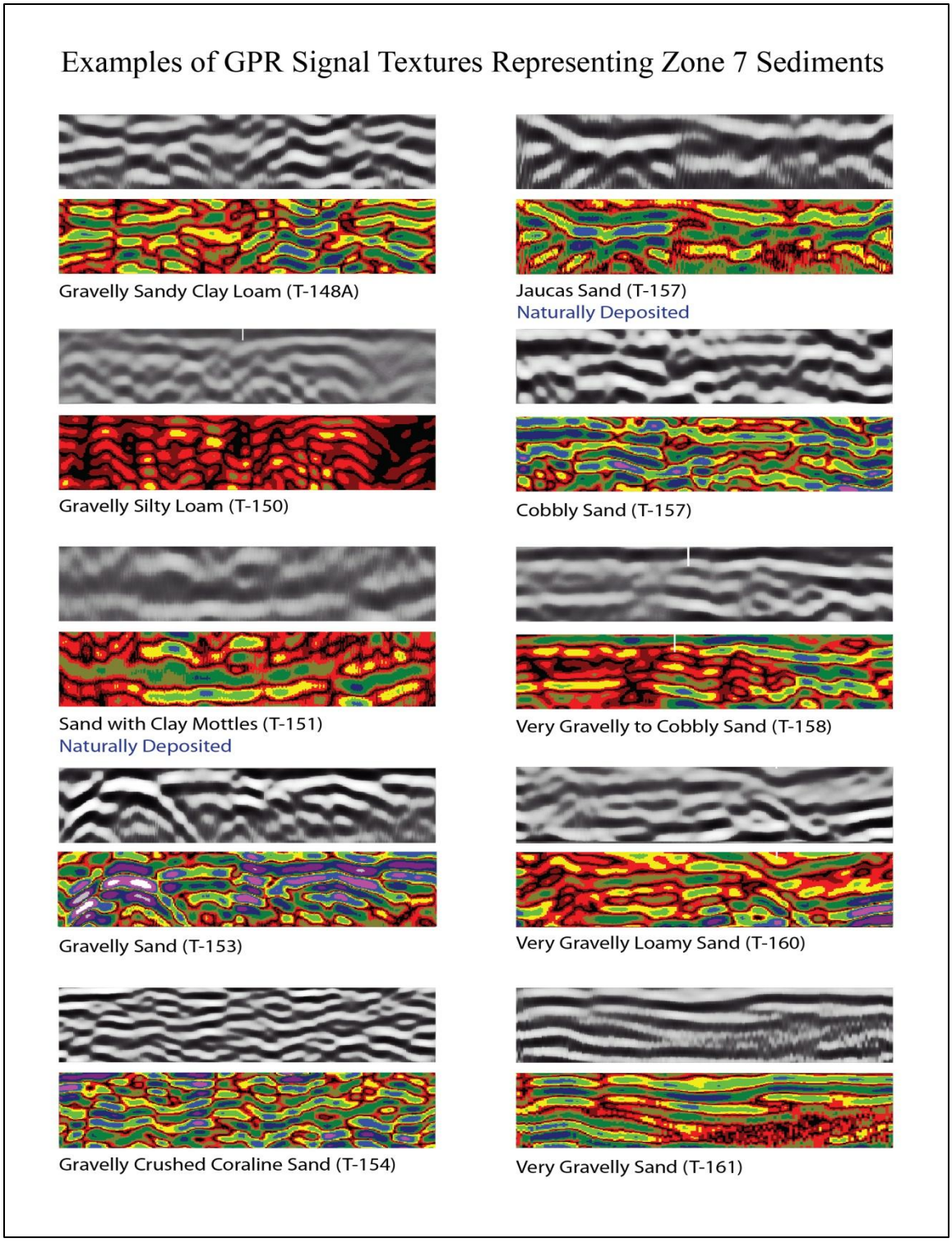

Figure 4. Examples of GPR signal textures representing Zone 7 sediments

Test Excavation 116

T-116 measured 0.6 m by 6.0 m and was oriented northwest to southeast and was located within the road cut on Halekauwila Street, 30.0 m southeast of South Nimitz Highway and Halekauwila Street intersection. The GPR grid measured 2.5 m by 10.0 m with 0.25 m spacing between Y transects, and 1.0 m spacing between X transects. Utilities located near the excavation include: sewer line 1.0 m southeast and 3.0 m northwest, electrical cable 5.6 m southeast. No utilities transected the excavation location.

A review of amplitude slice maps indicated linear features but not within excavation boundaries. Reflectivity was relatively uniform throughout the grid and decreased with depth except for the linear features. A transition from higher reflectivity to lower reflectivity was observed at approximately 0.5 mbs (Figure 5).

GPR depth profiles for T-116 identified horizontal banding, commonly associated with stratigraphic layering, throughout the survey area (Figure 6). This banding corresponded to variations of density and chemical composition within fill deposits. The profile also indicated a change in reflectivity that occurred around 0.25 mbs and again around 0.7 mbs. No utilities were observed in the profile. The maximum depth of clean signal return was approximately 1.25 mbs.

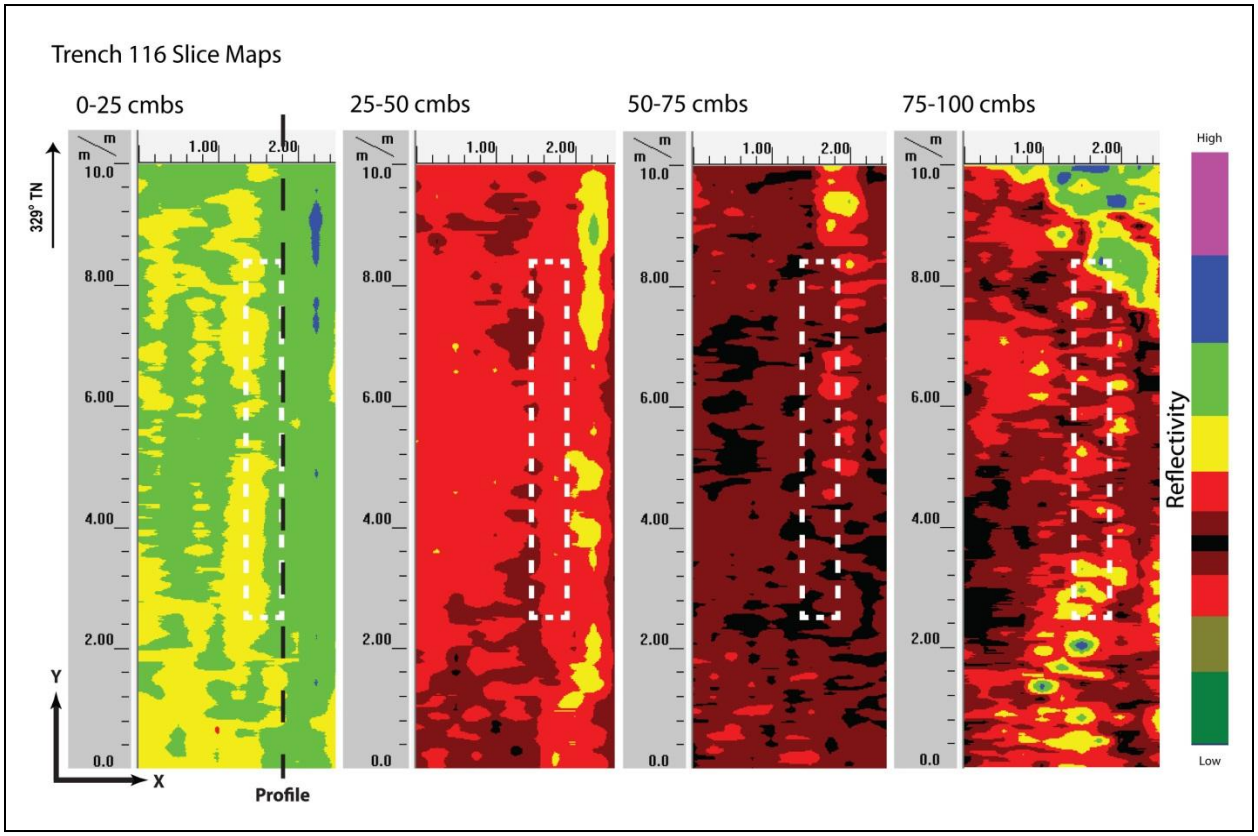

Figure 5. Slice maps of T-116 at 25cm depth intervals

A visual comparison of the excavated profile and the GPR signal profile showed a strong correlation in stratigraphic transitions (Figure 6). Strata Ia through Ih were clearly observed and occured at the ground-truthed depths. Strata Ia to Ic were individually discernible but strata Id to Ih were difficult to individually discern, possibly due to the fact that they were very thin layers of the very similar compacted fill, but based on reflectivity and horizontal banding it was apparent that there were multiple layers of fill events. No discrete objects were observed in the GPR results or subsequent excavation.

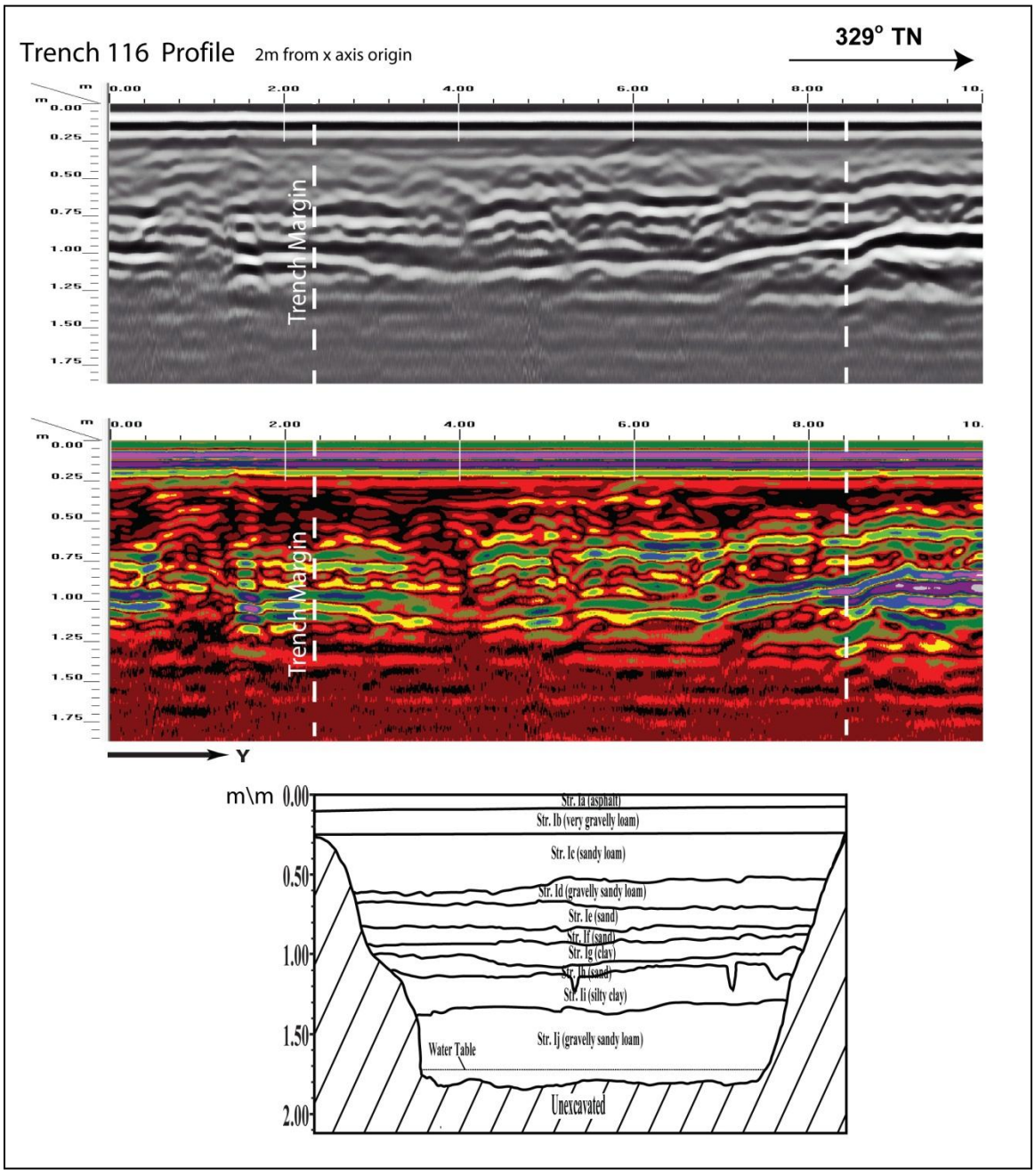

Figure 6. Visual comparison of excavated profile and GPR signal profile of T-116

Test Excavation 117

T-117 measured 0.7 m by 7.0 m and was oriented northwest to southeast and was located within the road cut of Halekauwila Street, 40.0 m northwest from Halekauwila Street and Mililani Street intersection. The GPR grid measured 3.0 m by 10.0 m with 0.25 m spacing between Y transects and 1.0 m spacing between X transects. Utilities located near the excavation include: water line 0.8 m northeast, electrical line 3.0 m east, sewer line 3.8 m east. A utility jacket was encountered approximately 0.22 mbs in the northwest corner, another utility jacket was encountered at approximately the same depth but in the southeast corner and a copper water pipe was encountered 0.6 mbs in the southeast end of the excavation.

A review of amplitude slice maps indicated linear features which might corresponded to the utility jackets encountered during excavation. Reflectivity was relatively uniform throughout the grid and decreased with depth except for the linear features. A transition from higher reflectivity to lower reflectivity was observed at approximately 0.5 mbs (Figure 7).

GPR depth profiles for T-117 identified horizontal banding, commonly associated with stratigraphic layering, throughout the survey area (Figure 8). This banding corresponded to variations of density and chemical composition within fill deposits. The profile also indicated a change in reflectivity that occurred around 0.25 mbs. Several anomalies were observed in the profile that corresponded to the copper pipe and the concrete utility jackets that were encountered during excavation. The maximum depth of clean signal return was approximately 1.25 mbs.

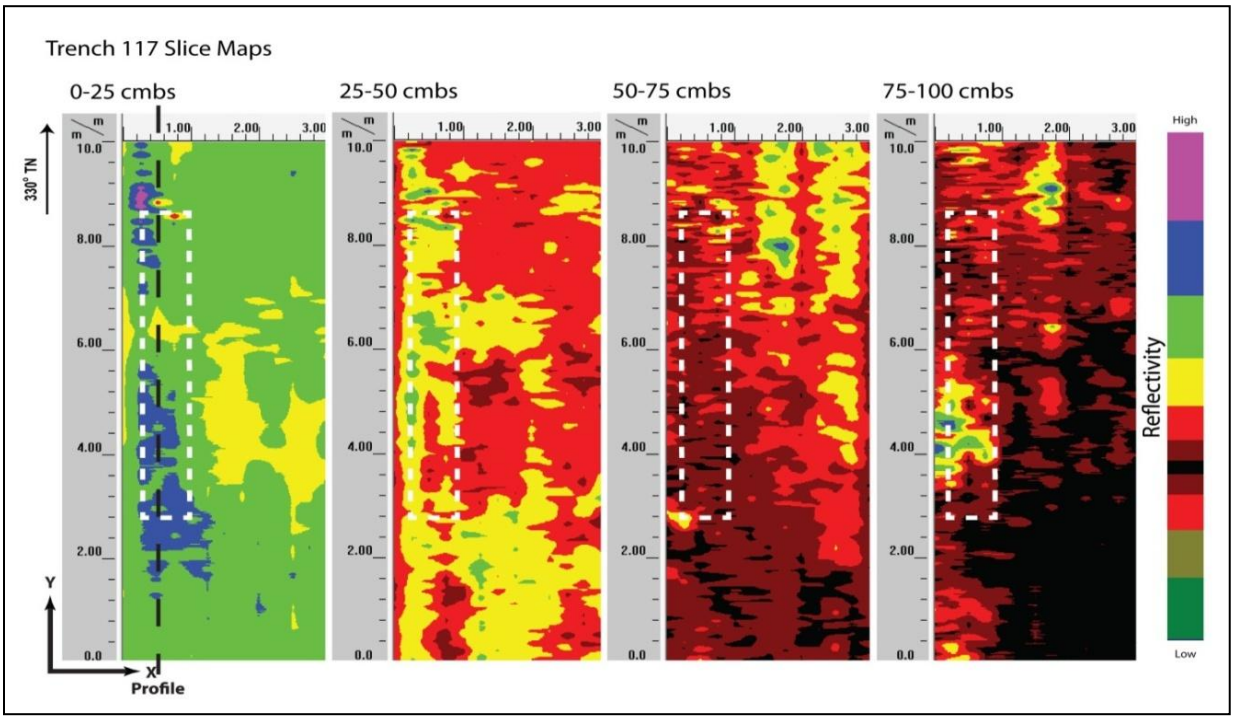

Figure 7. Slice maps of T-117 at 25cm depth intervals

A visual comparison of the excavated profile and the GPR signal profile showed a strong correlation in stratigraphic transitions (Figure 8). Strata Ia to Ic were clearly observed and occured at the ground-truthed depths. Textural changes in the form of multiple small hyperbolas were apparent in Stratum Ic which was gravelly sandy loam fill. Two concrete jackets and one copper pipe were found 0.22, 0.22 and 0.6 mbs, respectively. These jackets and pipe corresponded to several anomalies observed in the profile map. No other discrete objects were observed in the GPR results or subsequent excavation.

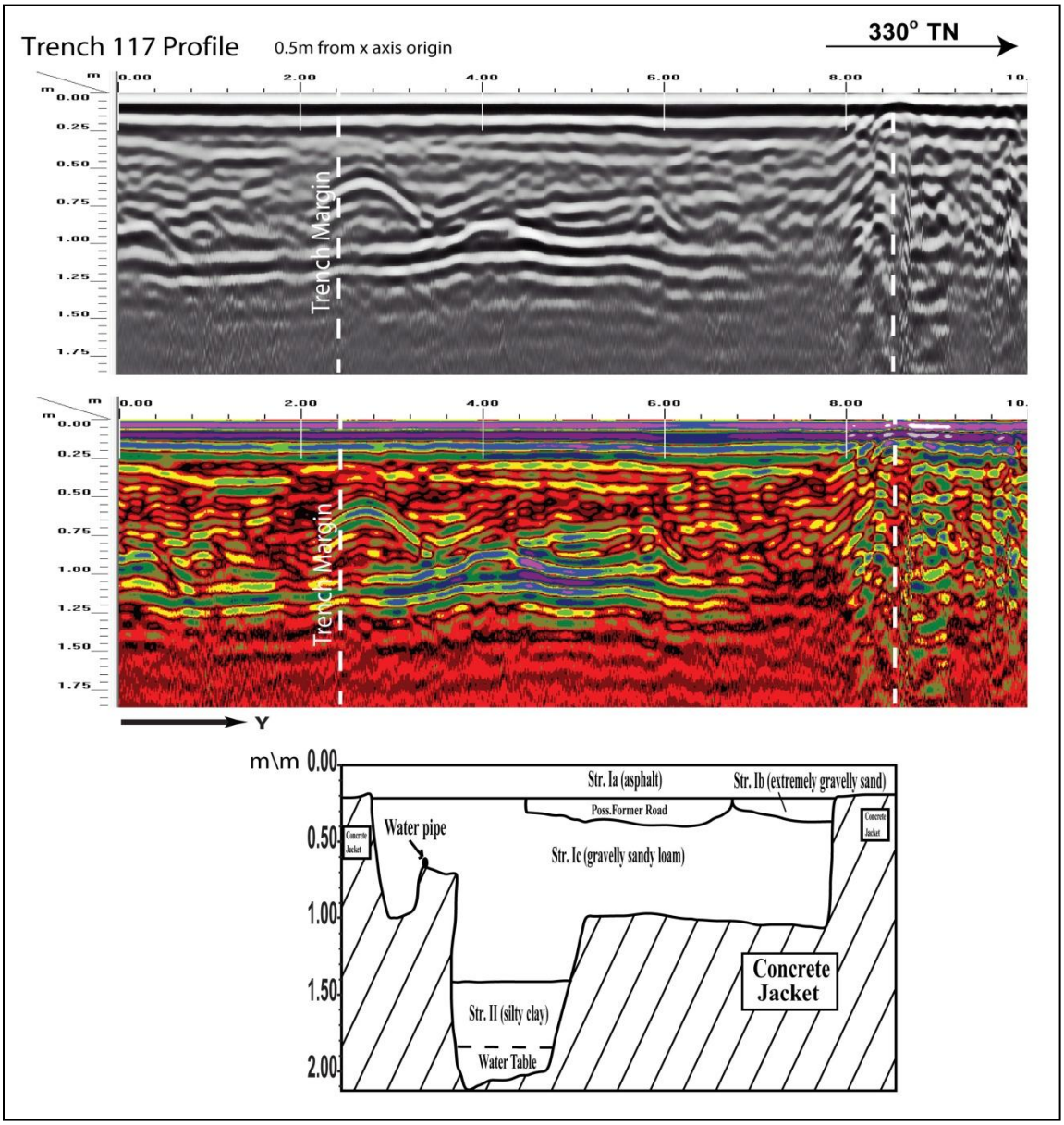

Figure 8. Visual comparison of excavated profile and GPR signal profile of T-117

Test Excavation 118

T-118 measured 0.6 m by 6.0 m and was oriented northwest to southeast and was located within the sidewalk on Halekauwila Street, 42.0 m southeast of Halekauwila Street and Mililani Street intersection. The GPR grid measured 1.5 m by 6.0 m with 0.25 m spacing between Y transects and 1.0 m spacing between X transects. Utilities located near the excavation include: sewer line one m northeast, storm drain 1.6 m southwest.

A review of amplitude slice maps indicated a linear feature which was a suspected water line but it was not ground-truthed. Reflectivity was relatively uniform throughout the grid and decreased with depth except for the linear feature. A transition from higher reflectivity to lower reflectivity was observed at approximately 0.75 mbs (Figure 9).

GPR depth profiles for T-118 identified horizontal banding, commonly associated with stratigraphic layering, throughout the survey area (Figure 10). This banding corresponded to variations of density and chemical composition within fill deposits. The profile also indicated a change in reflectivity that occurred around 0.15 mbs. An anomaly was observed in the profile and was suspected to be a water line but it was not ground-truthed. The maximum depth of clean signal return was approximately 0.9 mbs.

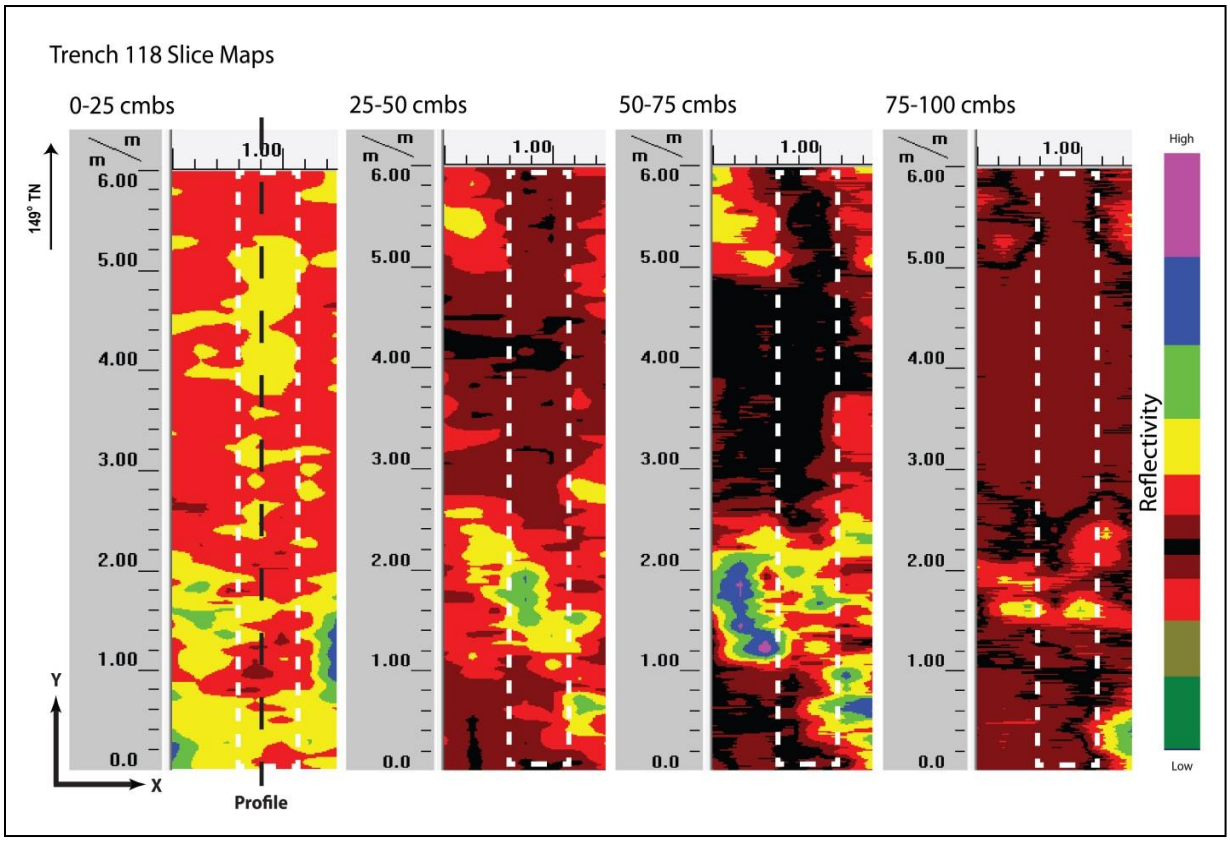

Figure 9. Slice maps of T-118 at 25cm depth intervals

A visual comparison of the excavated profile and the GPR signal profile showed a strong correlation in stratigraphic transitions (Figure 10). Strata Ia to Ic were clearly observed and occured at the ground-truthed depths. An anomaly was observed in the profile and corresponded to a suspected water line but it was not ground-truthed. All other sediment transitions were below the maximum clean signal return depth. No discrete objects were observed in the GPR results or subsequent excavation.

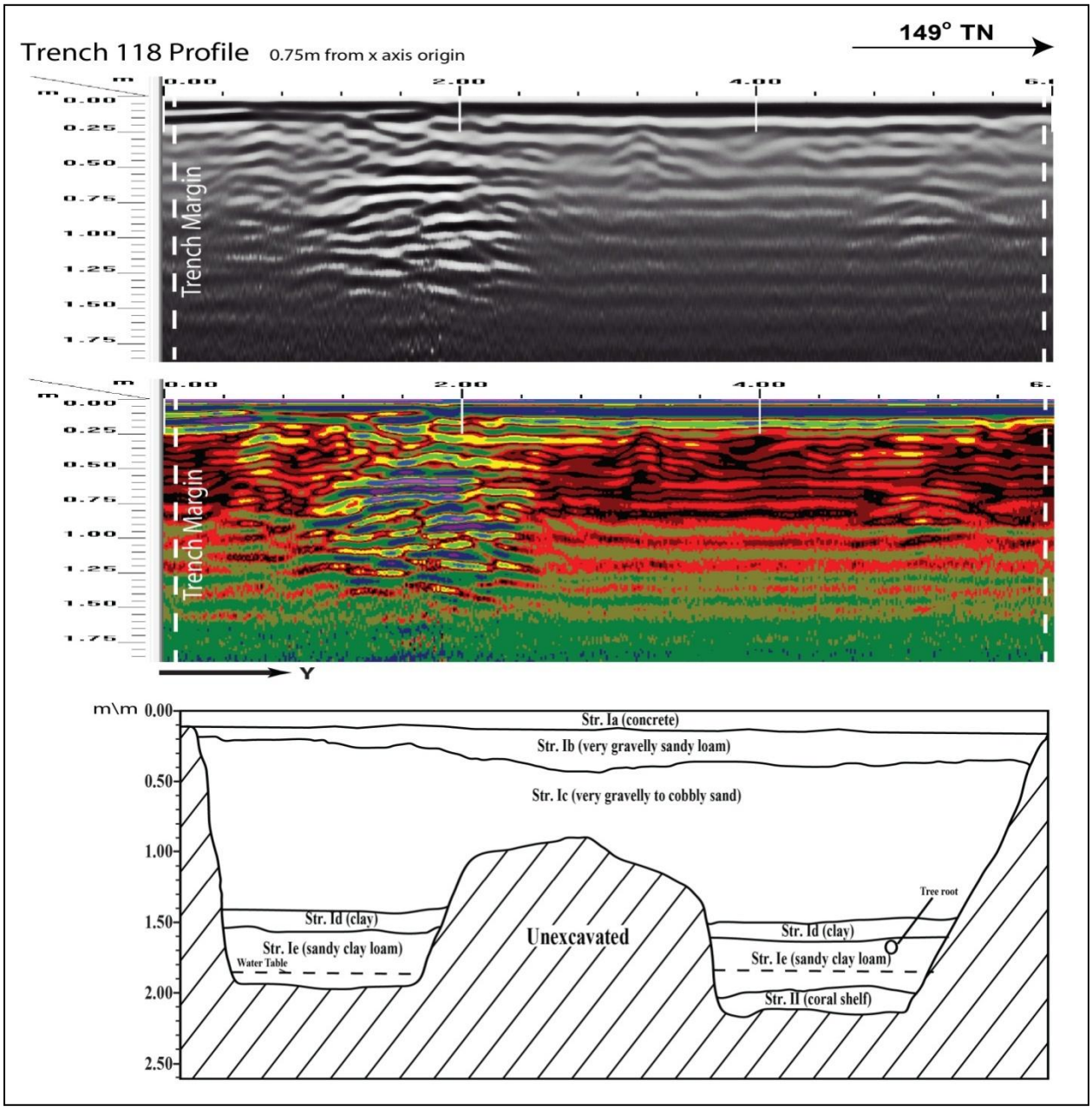

Figure 10. Visual comparison of excavated profile and GPR signal profile of T-118

Test Excavation 119

T-119 measured 1.0 m by 3.5 m and was oriented northeast to southwest and was located within a grassy median on Halekauwila Street, 70.0 m northwest of Halekauwila Street and Punchbowl Street intersection. The GPR grid measured 3.0 m by 6.0 m with 0.25 m spacing between Y transects and 1.0 m spacing between X transects. Utilities located near the excavation include: storm drain 5.0 m southwest. A PVC utility was encountered 0.35 mbs in the northeast end and a utility jacket was encountered 0.73 mbs in the northeast end of the excavation.

A review of amplitude slice maps indicated linear features but not within the excavation boundaries. Reflectivity was relatively uniform throughout the grid and decreased with depth except for the linear features. A transition from higher reflectivity to lower reflectivity was observed at approximately 0.25 mbs (Figure 11).

GPR depth profiles for T-119 identified horizontal banding, commonly associated with stratigraphic layering, throughout the survey area (Figure 12). This banding corresponded to variations of density and chemical composition within fill deposits. The profile also indicated a change in reflectivity that occurred around 0.2 mbs. An anomaly was observed in the profile and it corresponded to the utility and utility jacket encountered during excavation. The maximum depth of clean signal return was approximately 1.0 mbs.

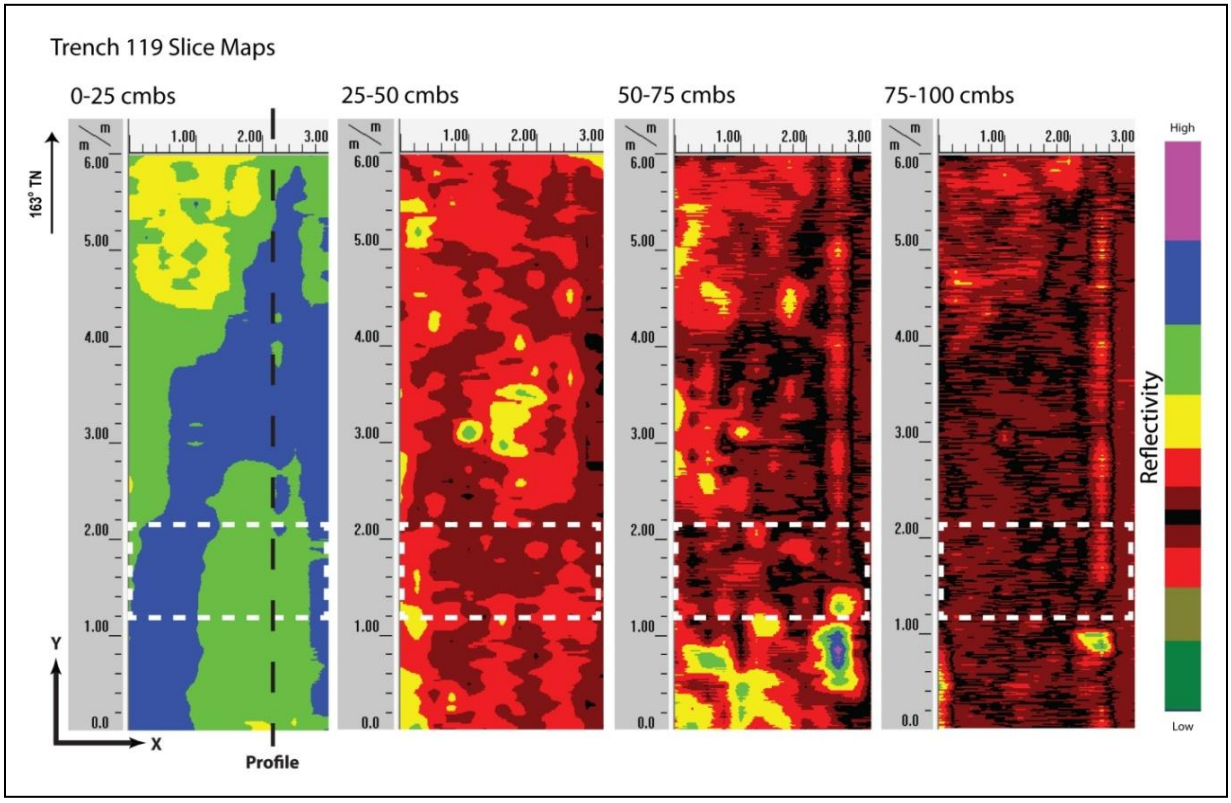

Figure 11. Slice maps of T-119 at 25cm depth intervals

A visual comparison of the excavated profile and the GPR signal profile showed a weak correlation in stratigraphic transitions (Figure 12). Strata included: silty clay fill, very gravelly sandy loam fill, gravelly sand fill, natural loamy silt, and natural sand. These transitions were not clearly depicted in the GPR profile at the depths that they occured. A PVC pipe and concrete jacket were found 0.35 and 0.73 mbs, respectively. The pipe and the jacket corresponded to an anomaly observed in the profile. A stone and mortar wall was also found 1.3 mbs but this was well beyond the maximum clean signal return depth. No other sediment transitions or discrete objects were observed in the GPR results or subsequent excavation.

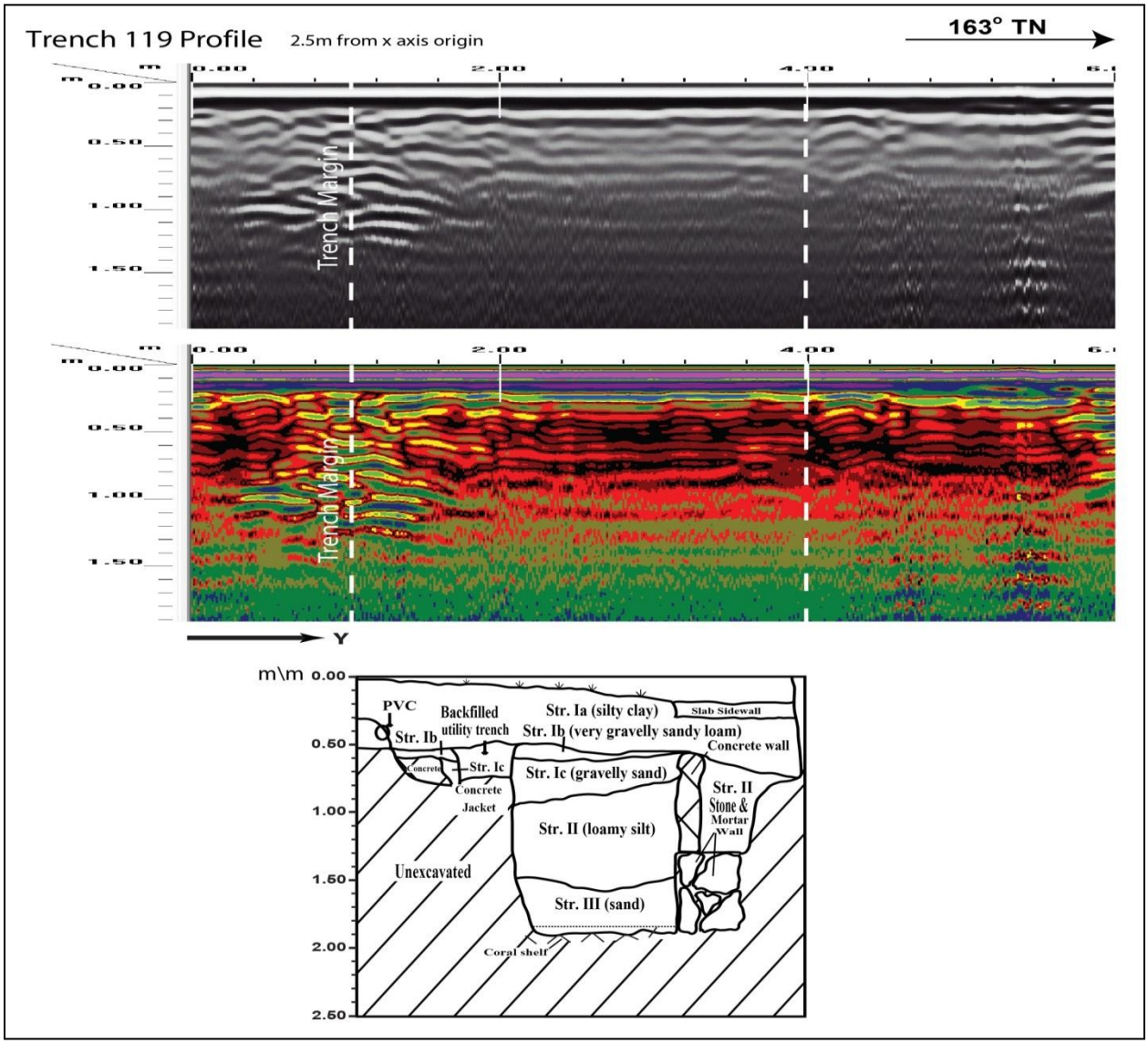

Figure 12. Visual comparison of excavated profile and GPR signal profile of T-119

Test Excavation 119A

T-119A measured 0.9 m by 3.0 m and was oriented northwest to southeast and was located within the sidewalk on Halekauwila Street, 65.0 m northwest of Halekauwila Street and Punchbowl Street intersection. The GPR grid measured 3.0 m by 6.0 m with 0.25 m spacing between Y transects and 1.0 m spacing between X transects. Utilities located near the excavation include: storm drain 4.6 m southwest. No utilities transected the GPR grid or excavation location.

A review of amplitude slice maps indicated no linear features which might indicate the presence of utilities. Reflectivity was relatively uniform throughout the grid and decreased with depth. A transition from higher reflectivity to lower reflectivity was observed at approximately 0.5 mbs (Figure 13).

GPR depth profiles for T-119A identified horizontal banding, commonly associated with stratigraphic layering, throughout the survey area (Figure 14). This banding corresponded to variations of density and chemical composition within fill deposits. The profile also indicated a change in reflectivity that occurred around 0.2 mbs. An anomaly was observed in the profile but was not encountered during excavation. The maximum depth of clean signal return was approximately 0.75 mbs.

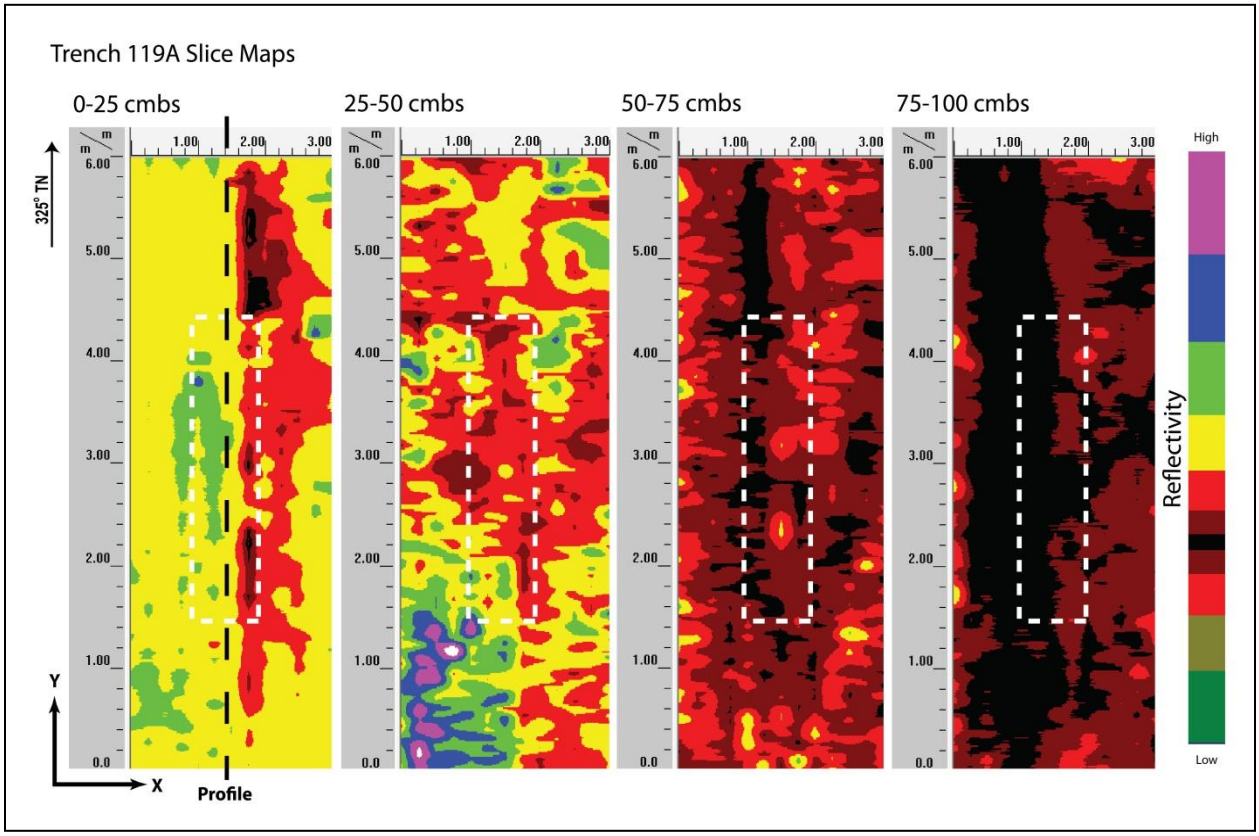

Figure 13. Slice maps of T-119A at 25cm depth intervals

A visual comparison of the excavated profile and the GPR signal profile showed a strong correlation in stratigraphic transitions (Figure 14). Strata Ia to IIa were clearly observed and occured at the ground-truthed depths. Textural changes in the form of multiple small hyperbolas were apparent in Stratum Ic which was very gravelly sand. All other sediment transitions were below the maximum depth for clean signal return. No discrete objects were observed in the GPR results or subsequent excavation.

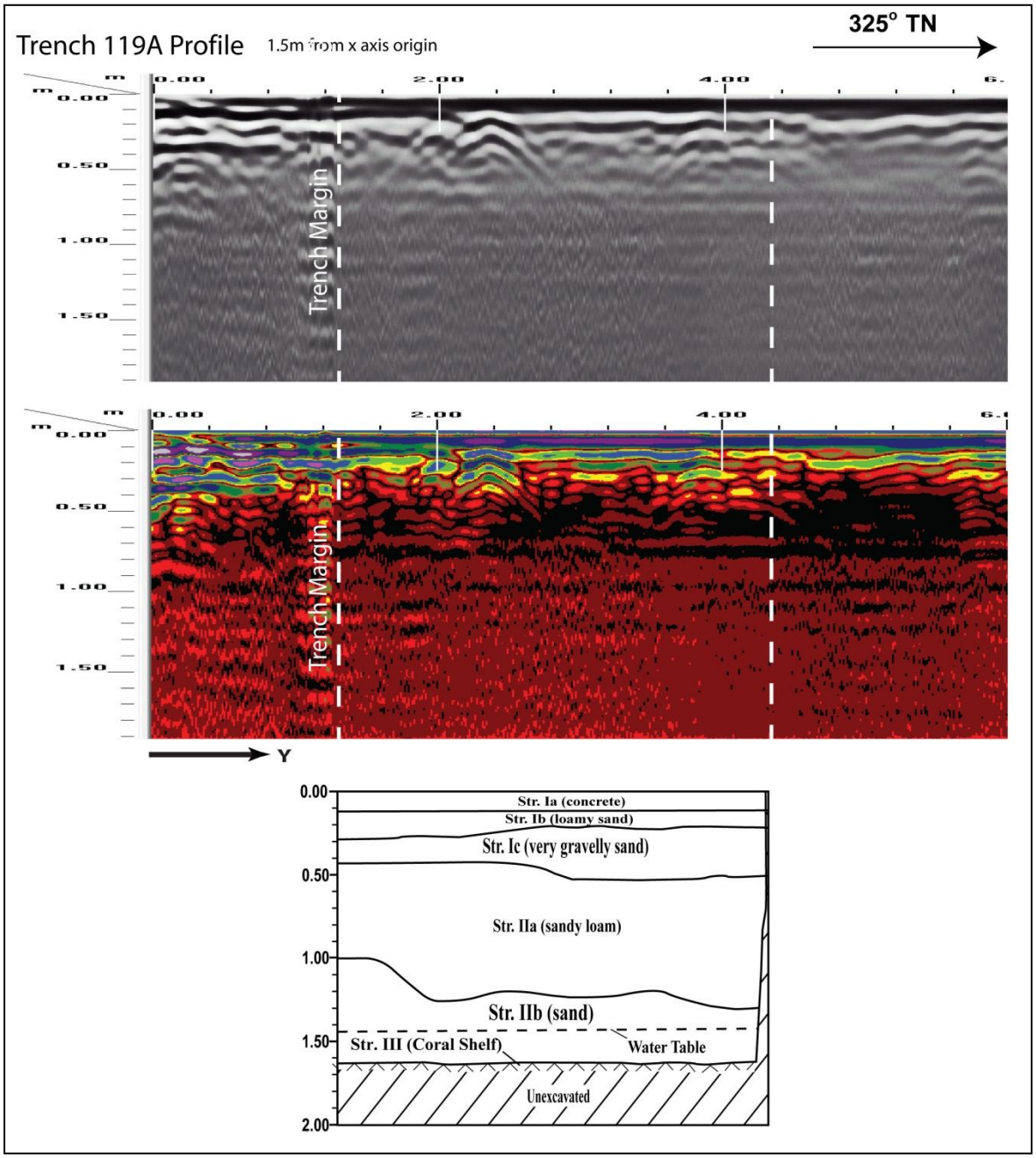

Figure 14. Visual comparison of excavated profile and GPR signal profile of T-119A

Test Excavation 120

T-120 measured 0.6 m by 6.0 m and was oriented northwest to southeast and was located within the road cut of Halekauwila Street, 70.0 m northwest of Halekauwila Street and Punchbowl Street intersection. The GPR grid measured 2.5 m by 10.0 m with 0.25 m spacing between Y transects and 1.0 m spacing between X transects. Utilities located near the excavation include: storm drain 2.5 m southwest, sewer line 3.6 m southwest. A 10.0 cm abandoned metal pipe was encountered approximately 0.5 mbs on the north end of the excavation.

A review of amplitude slice maps indicated a linear feature and could corresponded to the abandoned utility encountered during excavation. Reflectivity was relatively uniform throughout the grid and decreased with depth. A transition from higher reflectivity to lower reflectivity was observed at approximately 0.5 mbs (Figure 15).

GPR depth profiles for T-120 identified horizontal banding, commonly associated with stratigraphic layering, throughout the survey area (Figure 16). This banding corresponded to variations of density and chemical composition within fill deposits. The profile also indicated a change in reflectivity that occurred around 0.25 mbs and again around 0.75 mbs. An anomaly was observed in the profile and corresponded to the utility encountered during excavation. The maximum depth of clean signal return was approximately 0.9 mbs.

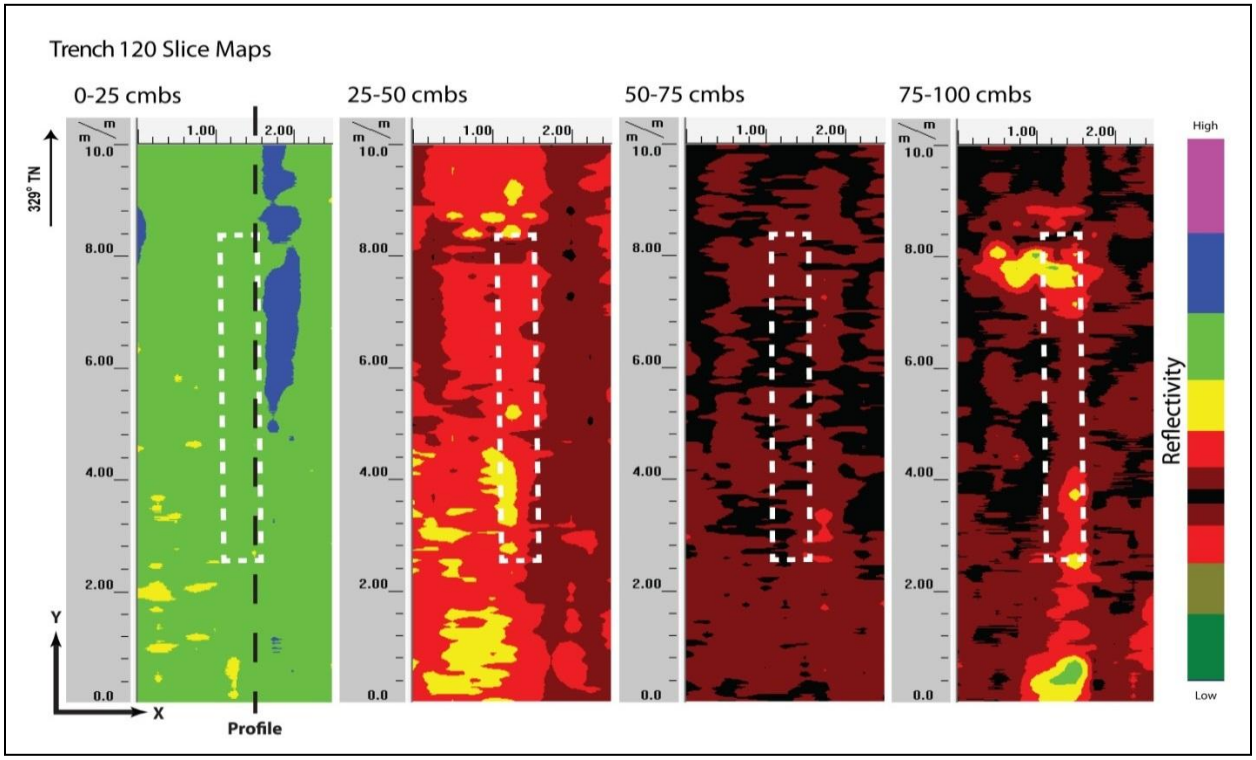

Figure 15. Slice maps of T-120 at 25cm depth intervals

A visual comparison of the excavated profile and the GPR signal profile showed a strong correlation in stratigraphic transitions (Figure 16). Strata Ia to II were clearly observed and occured at the ground-truthed depths. Strata included: aspahlt, concrete, gravelly sandy clay fill, natural loamy sand, and natural sand. A metal pipe was found 0.5 mbs. This corresponded to a hyperbola anomaly observed in the profile. No other discrete objects or stratigraphic transitions were observed in the GPR results or subsequent excavation.

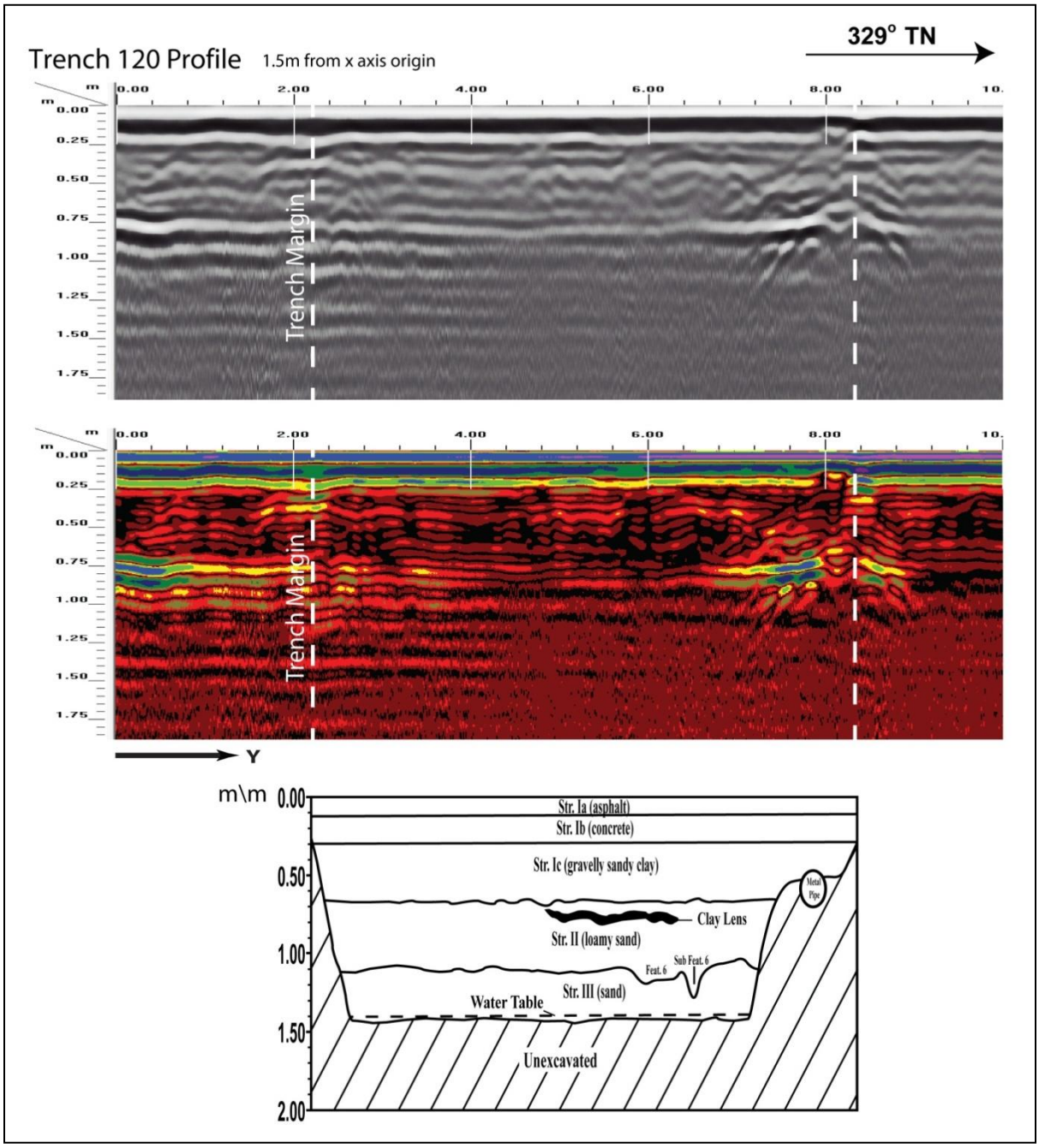

Figure 16. Visual comparison of excavated profile and GPR signal profile of T-120

Test Excavation 120A

T-120A measured 0.6 m by 6.0 m and was oriented northwest to southeast and was located within the side walk northwest of Halekauwila Street, 75.0 m southeast of Halekauwila Street and Mililani Street intersection. The GPR grid measured 2.0 m by 8.0 m with 0.25 m spacing between Y transects and 1.0 m spacing between X transects. Utilities located near the excavation include: storm drain 2.3 m southwest and 4.8 m southwest, sewer line 3.7 m northeast. A concrete surface was encountered 0.15 mbs and spanned most of the length of the excavation and a pipe was encountered 0.4 mbs on the southeast end of the excavation.

A review of amplitude slice maps indicated no linear features although a concrete surface was encountered during excavation. Reflectivity was relatively uniform throughout the grid and decreased with depth. A transition from higher reflectivity to lower reflectivity was observed at approximately 0.5 mbs (Figure 17).

GPR depth profiles for T-120A identified horizontal banding, commonly associated with stratigraphic layering, throughout the survey area (Figure 18). This banding corresponded to variations of density and chemical composition within fill deposits. The profile also indicated a change in reflectivity that occurred around 0.2 mbs. Anomalies were observed in the profile and corresponded to the concrete surface and pipe that were encountered. The maximum depth of clean signal return was approximately 0.75 mbs.

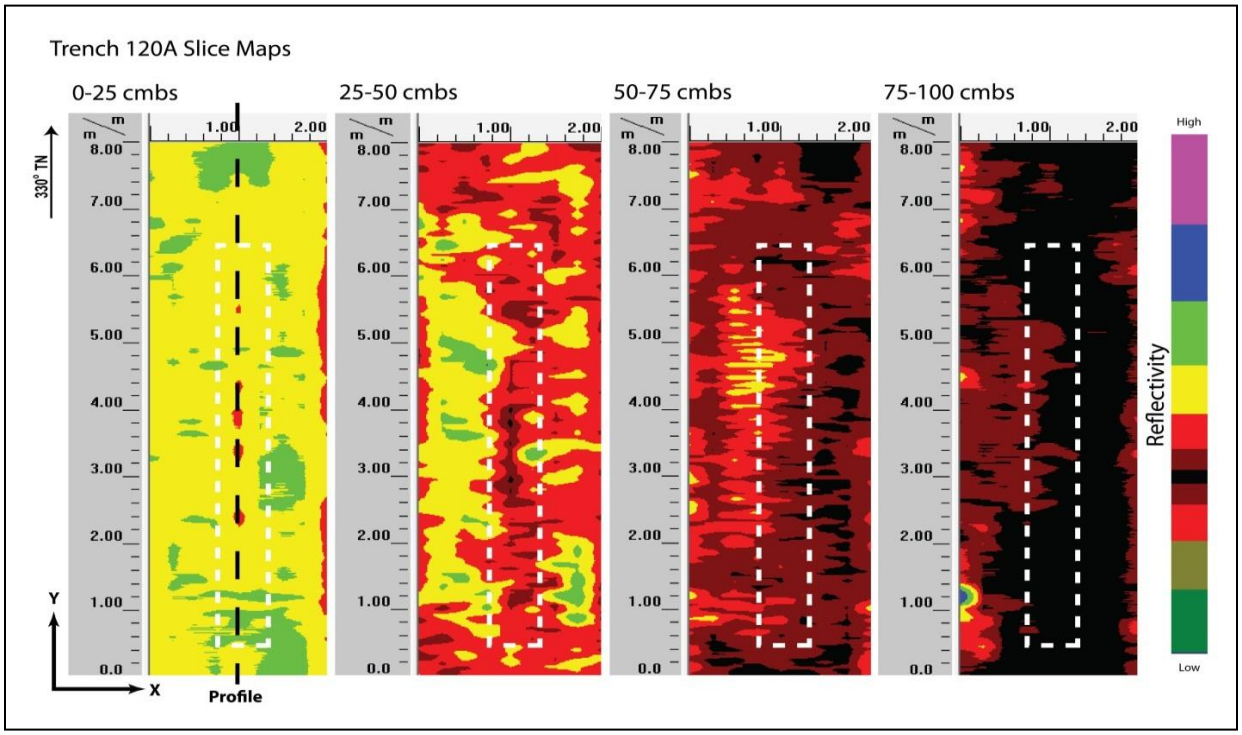

Figure 17. Slice maps of T-120A at 25cm depth intervals

A visual comparison of the excavated profile and the GPR signal profile showed a strong correlation in stratigraphic transitions (Figure 18). Strata Ia through Ic, including the concrete driveway, were clearly observed and occured at the ground-truthed depths. A pipe and concrete slab were found 0.4 and 0.15 mbs, respectively. The pipe corresponded to a void observed in the profile. The concrete slab corresponded to a signal observed around 0.2 mbs. All other sediment transitions were below the maximum clean signal return depth. No other discrete objects were observed in the GPR results or subsequent excavation.

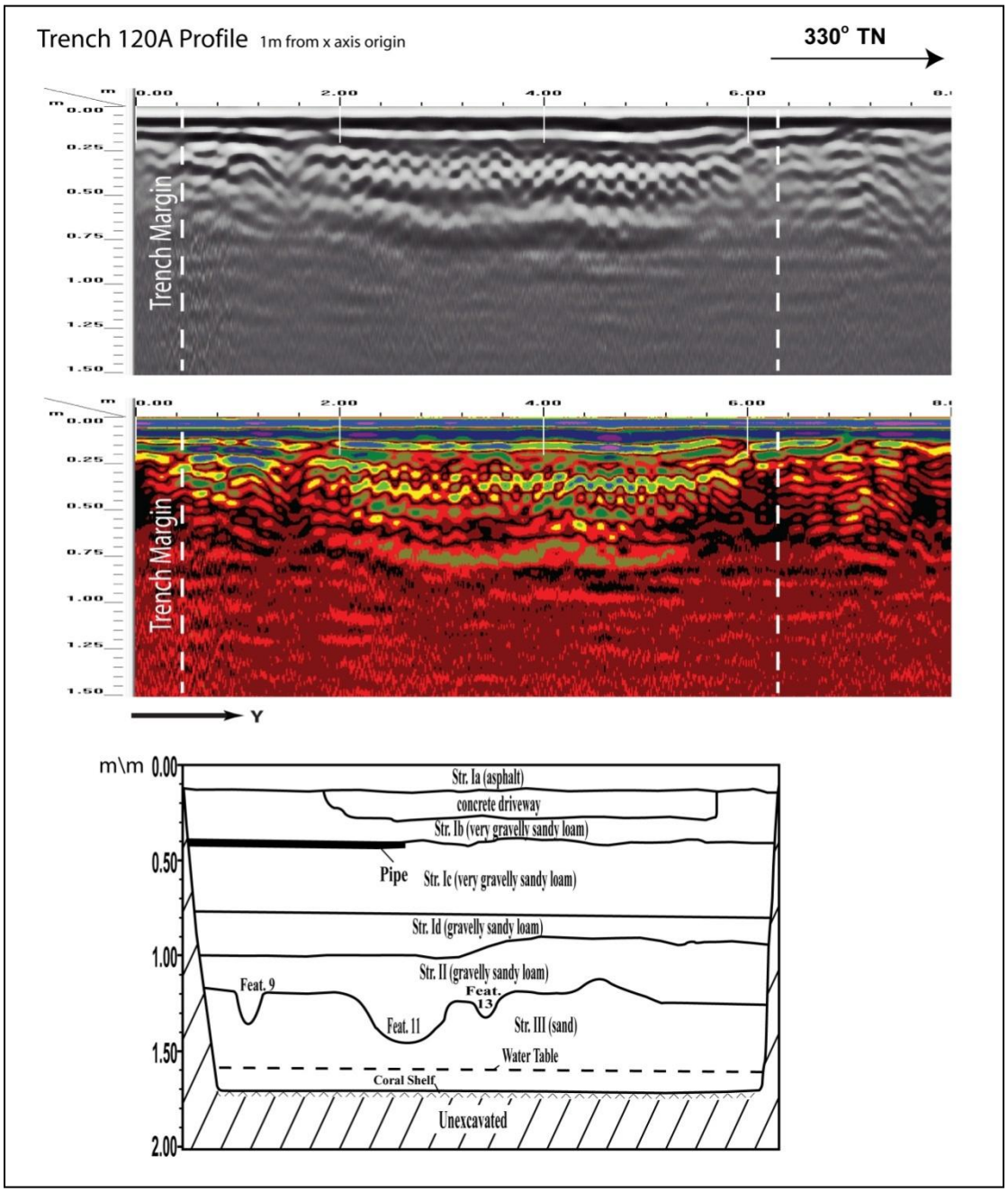

Figure 18. Visual comparison of excavated profile and GPR signal profile of T-120A

Test Excavation 120B

T-120B measured 0.6 m by 6.0 m and was oriented northwest to southeast and was located within the sidewalk east of Halekauwila Street and 40.0 m northwest of Halekauwila Street and Punchbowl Street intersection. The GPR grid measured 2.0 m by 7.0 m with 0.25 m spacing between Y transects and 1.0 m spacing between X transects. Utilities located near the excavation include: storm drains 2.8 m southwest and 1.5 m north. A concrete slab was encountered 0.27 mbs in the northern corner and a utility was encountered 0.67 mbs in the southern corner of the excavation.

A review of amplitude slice maps indicated no linear features which might indicate the presence of utilities although a concrete slab and utility line were encountered during excavation. Reflectivity was relatively uniform throughout the grid and decreased with depth. A transition from higher reflectivity to lower reflectivity was observed at approximately 0.5 mbs (Figure 19).

GPR depth profiles for T-120B identified horizontal banding, commonly associated with stratigraphic layering, throughout the survey area (Figure 20). This banding corresponded to variations of density and chemical composition within fill deposits. The profile also indicated a change in reflectivity that occurred around 0.2 mbs. An anomaly was observed in the profile but not within excavation boundaries. The maximum depth of clean signal return was approximately 0.75 mbs.

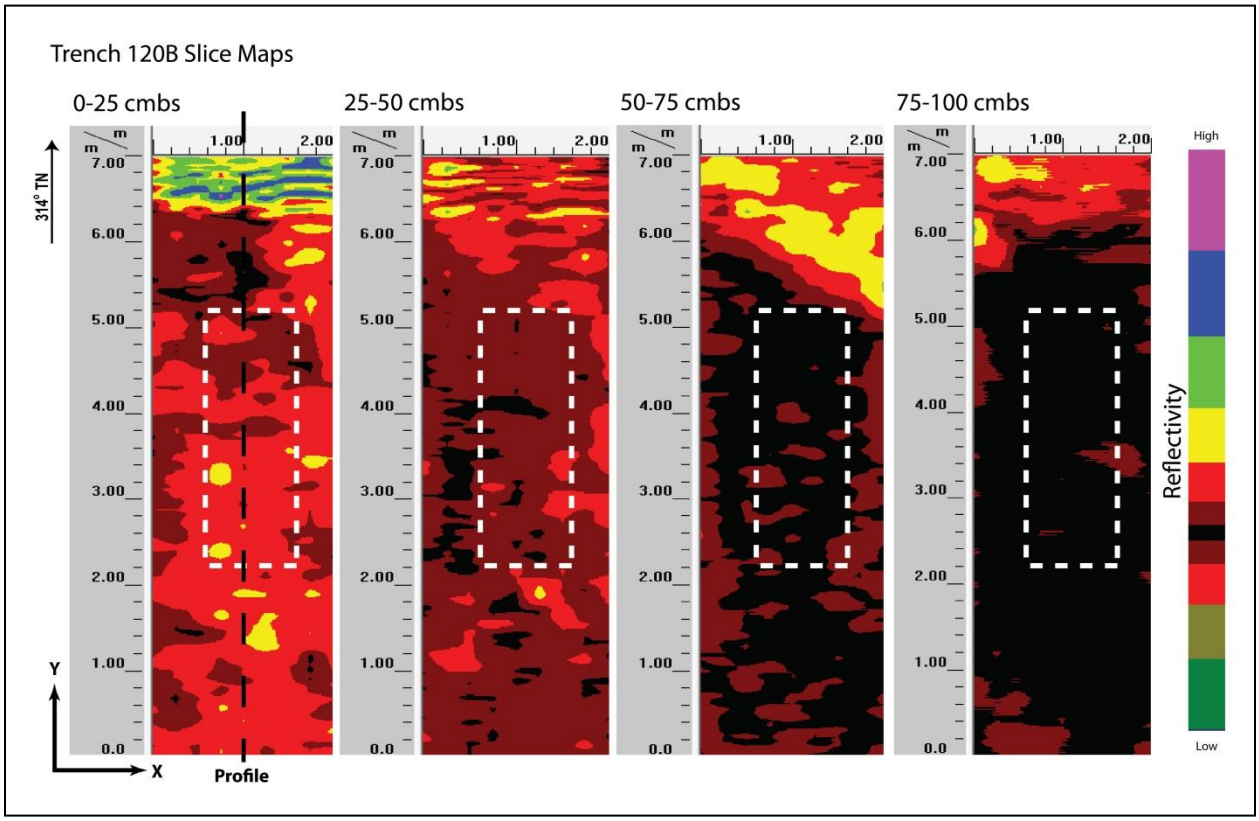

Figure 19. Slice maps of T-120B at 25cm depth intervals

A visual comparison of the excavated profile and the GPR signal profile showed a moderate correlation in stratigraphic transitions (Figure 20). Strata Ia and Ib were all clearly observed and occured near the ground-truthed depths. A concrete slab and utility pipe were found 0.27 and 0.67 mbs, respectively. The pipe and the concrete slab did not showed up in the profile or slice maps. No other discrete objects were observed in the GPR results or subsequent excavation.

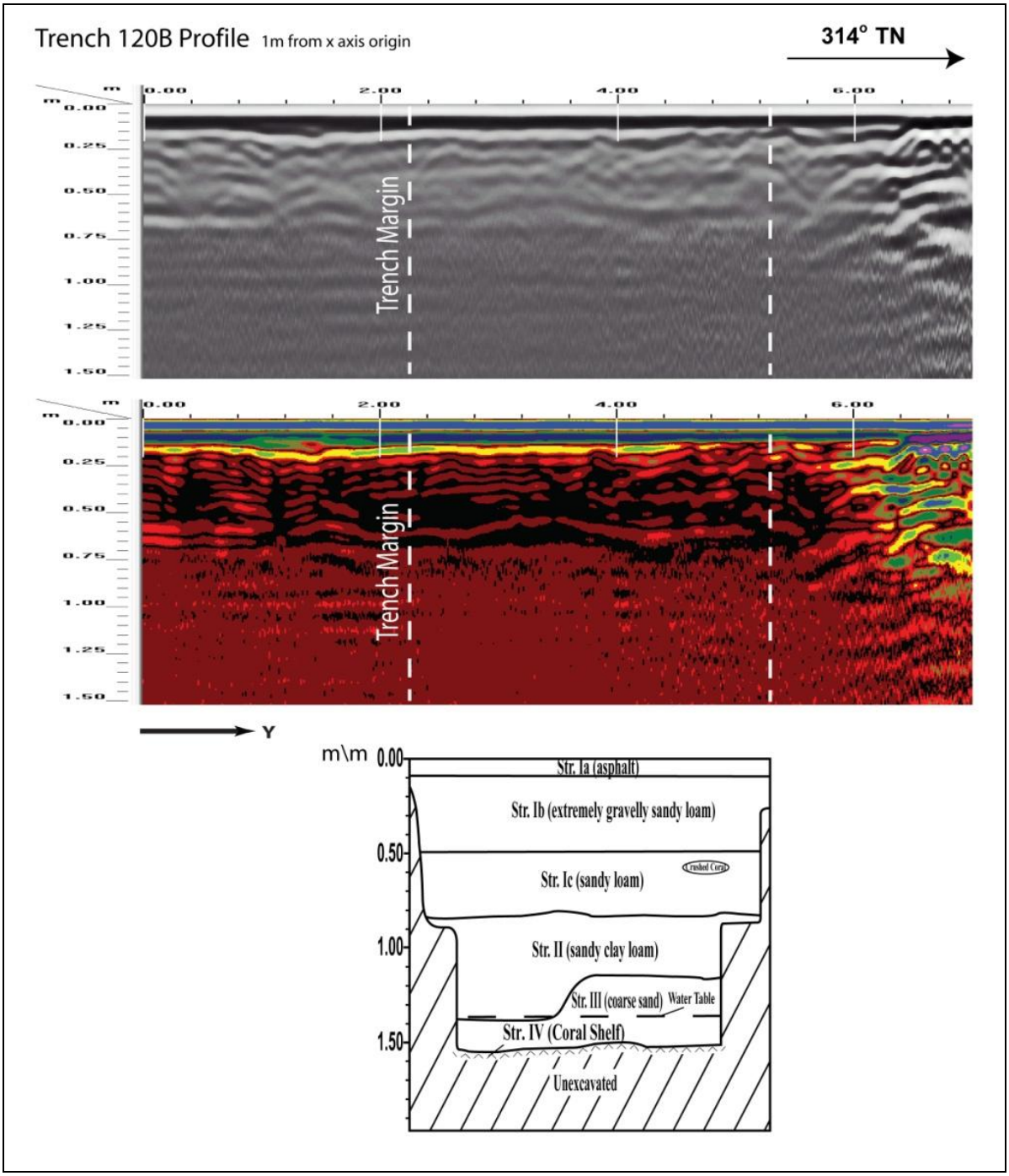

Figure 20. Visual comparison of excavated profile and GPR signal profile of T-120B

Test Excavation 121

T-121 measured 0.9 m by 7.0 m and was oriented northwest to southeast and was located within the sidewalk on Halekauwila Street, 20.0 m northwest of Halekauwila Street and Punchbowl Street intersection. The GPR grid measured 3.0 m by 6.0 m with 0.25 m spacing between Y transects and 1.0 m spacing between X transects. Utilities located near the excavation include: sewer line 1.3 m southwest. A utility pipe was encountered approximately 0.8 mbs in the southeast end of the excavation.

A review of amplitude slice maps indicated a linear features but not within excavation boundaries. Reflectivity was relatively uniform throughout the grid and decreased with depth except for the linear feature. A transition from higher reflectivity to lower reflectivity was observed at approximately 0.5 mbs (Figure 21).

GPR depth profiles for T-121 identified horizontal banding, commonly associated with stratigraphic layering, throughout the survey area (Figure 22). This banding corresponded to variations of density and chemical composition within fill deposits. The profile also indicated a change in reflectivity that occurred around 0.2 mbs. An anomaly was observed in the profile and could corresponded to the utility encountered during excavation. The maximum depth of clean signal return was approximately 0.9 mbs.

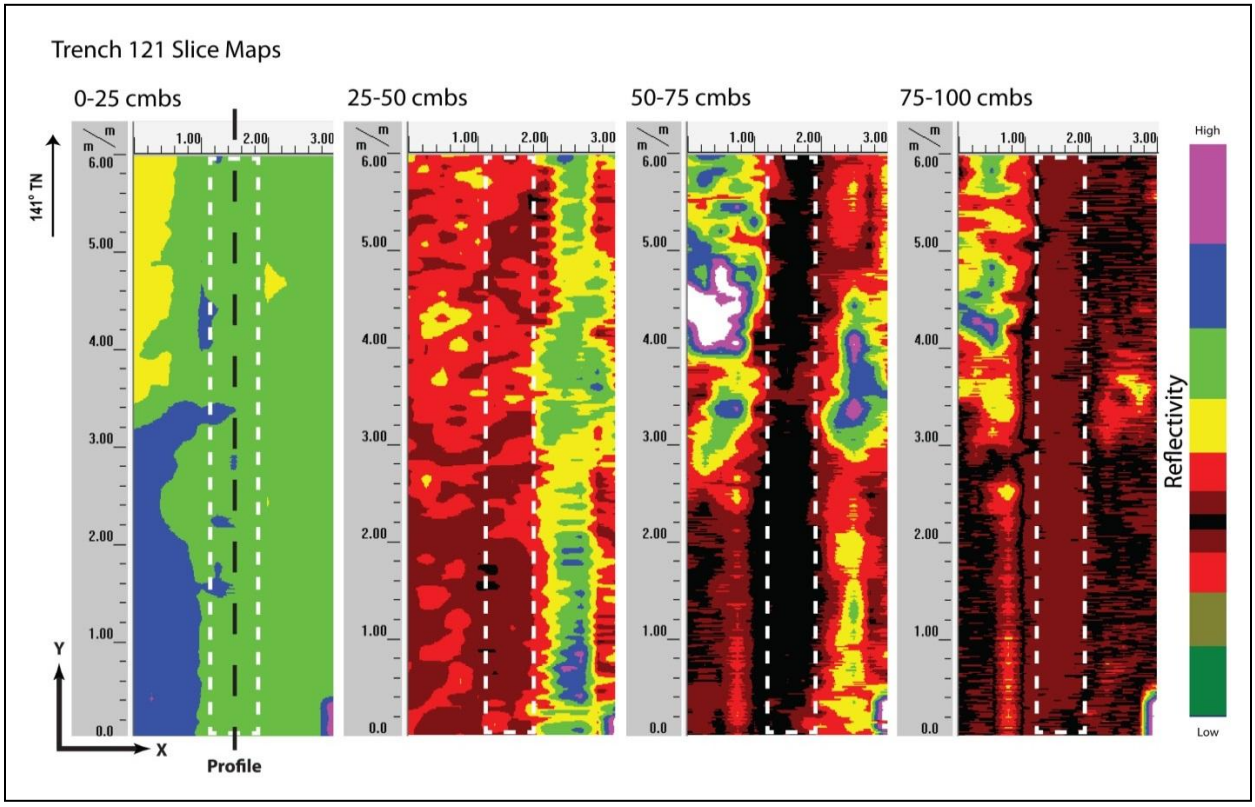

Figure 21. Slice maps of T-121 at 25cm depth intervals

A visual comparison of the excavated profile and the GPR signal profile showed a strong correlation in stratigraphic transitions (Figure 22). Strata Ia to Ic were clearly observed and occured at the ground-truthed depths. Textural changes in the form of multiple small hyperbolas were apparent in Stratum Ic which was gravelly to stony sandy loam fill. A pipe was found 0.8 mbs. This pipe seems to corresponded to an anomaly in the profile. All other sediment transitions were below the maximum depth of clean signal return. No other discrete objects were observed in the GPR results or subsequent excavation.

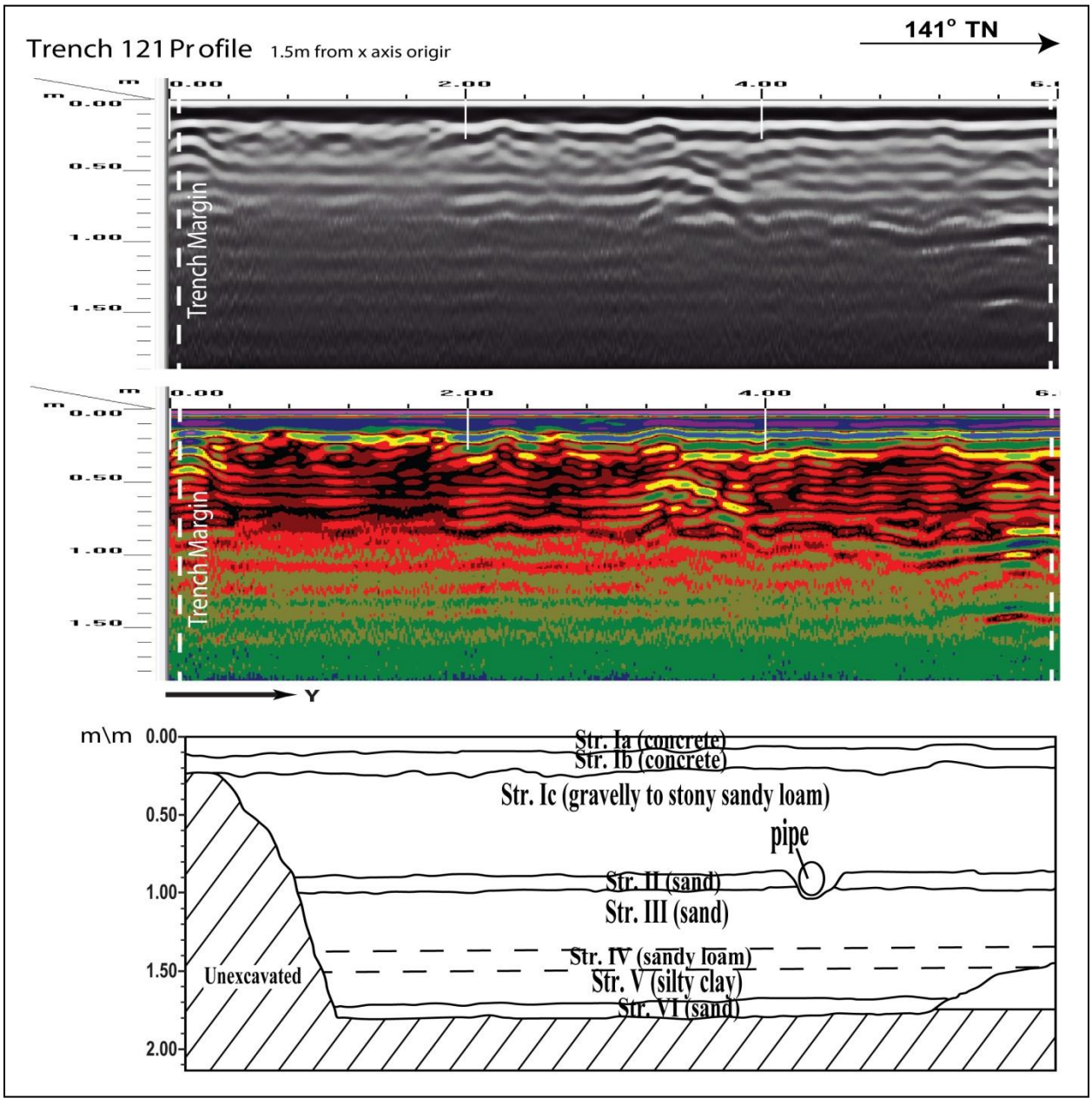

Figure 22. Visual comparison of excavated profile and GPR signal profile of T-121

Test Excavation 122

T-122 measured 0.9 m by 3.0 m and was oriented northwest to southeast and was located within the road cut of Halekauwila Street, 20.0 m southeast of Halekauwila Street and Punchbowl Street intersection. The GPR grid measured 2.5 m by 8.0 m with 0.25 m spacing between Y transects and 1.0 m spacing between X transects. Utilities located near the excavation include: storm drain 0.6 m northwest, water line 0.7 m southwest, electrical line 0.7 m northeast. No utilities transected the excavation location.

A review of amplitude slice maps indicated a linear feature but not within excavation boundaries. Reflectivity was relatively uniform throughout the grid. A transition from higher reflectivity to lower reflectivity was observed at approximately 0.75 mbs (Figure 23).

GPR depth profiles for T-122 identified horizontal banding, commonly associated with stratigraphic layering, throughout the survey area (Figure 24). This banding corresponded to variations of density and chemical composition within fill deposits. The profile also indicated a change in reflectivity that occurred around 0.15 mbs. An anomaly was observed in the profile but not within excavation boundaries. The maximum depth of clean signal return was approximately 1.0 mbs.

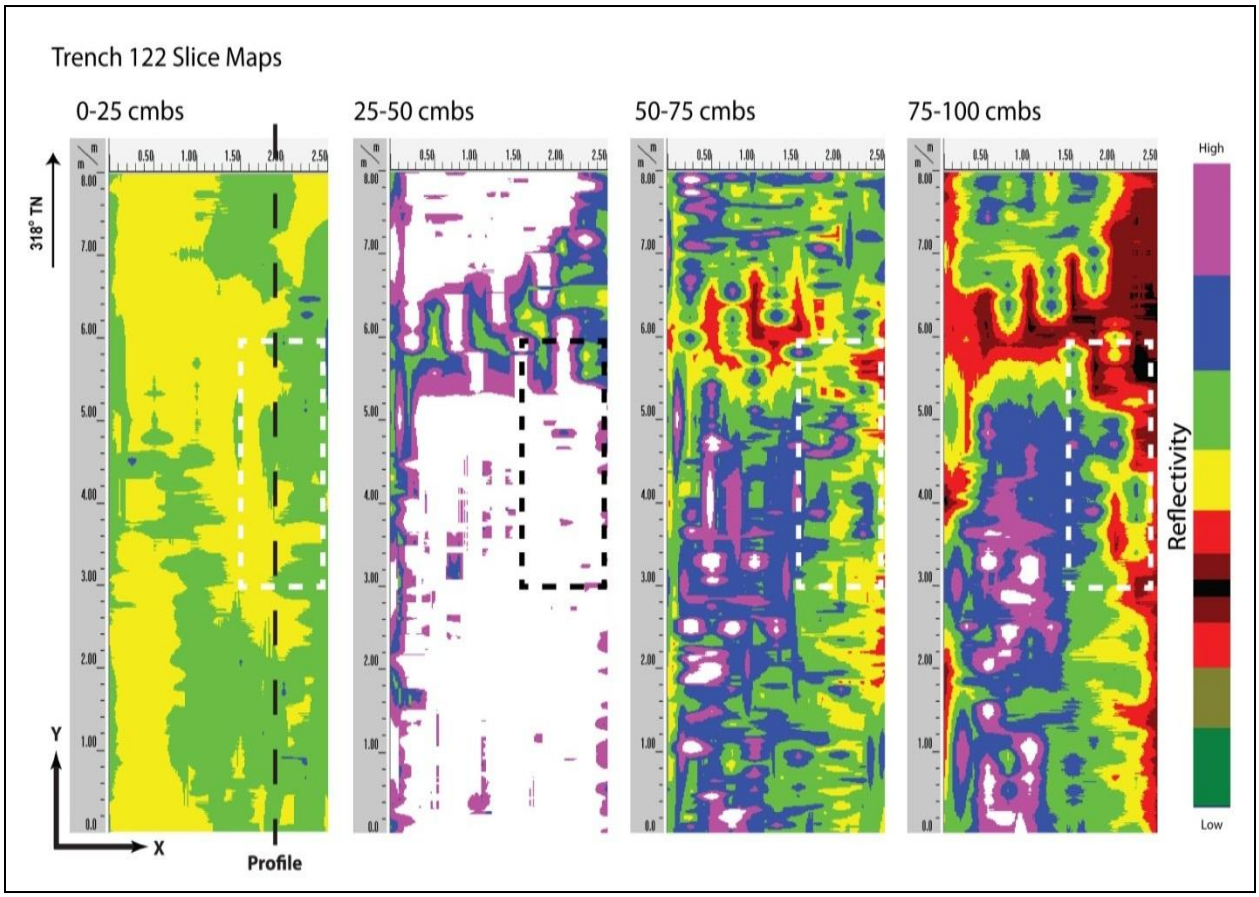

Figure 23. Slice maps of T-122 at 25 cm depth intervals

A visual comparison of the excavated profile and the GPR signal profile showed a weak correlation in stratigraphic transitions (Figure 24). Strata included: asphalt, very cobbly sand, multiple sand fill layers, sandy clay fill, and natural clay loam pond sediment. These transitions were not clearly depicted in the GPR profile at the depths that they occured. No other sediment transitions or discrete objects were observed in the GPR results or subsequent excavation.

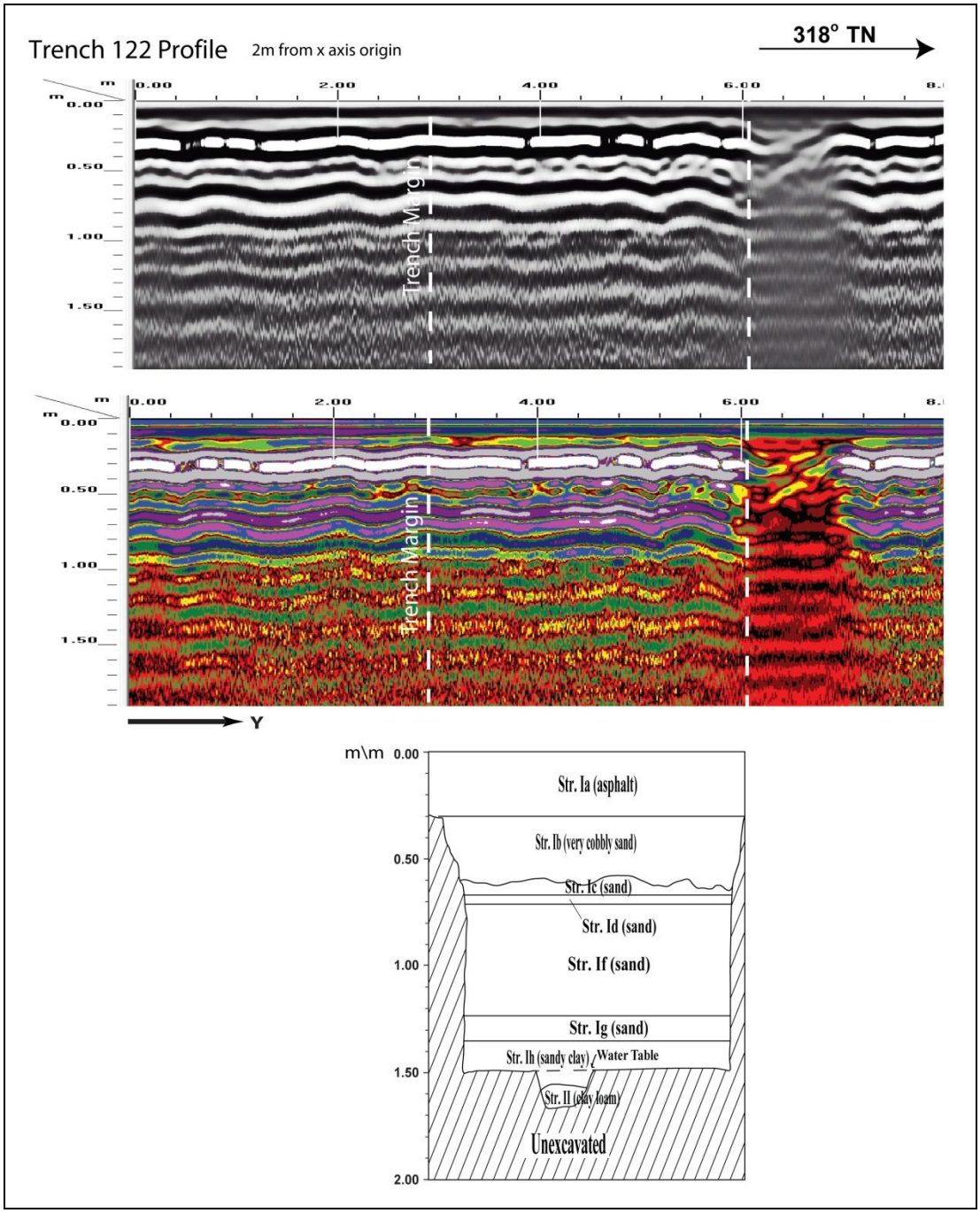

Figure 24. Visual comparison of excavated profile and GPR signal profile of T-122

Test Excavation 122A

T-122A measured 0.9 m by 3.0 m and was oriented northeast to southwest and was located within the sidewalk, 5.3 m east of Halekauwila Street and Punchbowl Street intersection. The GPR grid measured 3.0 m by 6.0 m with 0.25 m spacing between Y transects and 1.0 m spacing between X transects. Utilities located near the excavation include: fiber optic cable 3.4 m north and a storm drain 1.5 m south. A concrete slab was encountered 0.2 mbs on the southwestern end, several pipes were encountered 0.56 mbs running diagonally through the center, a traffic light electric line was encountered 0.5 mbs and several pipes were encountered 0.3-0.45 mbs on the northeastern end of the excavation.

A review of amplitude slice maps indicated linear features that may corresponded to the utilities that were encountered during excavation. Reflectivity was relatively uniform throughout the grid and decreased with depth. A transition from higher reflectivity to lower reflectivity was observed at approximately 0.75 mbs (Figure 25).

GPR depth profiles for T-122A identified horizontal banding, commonly associated with stratigraphic layering, throughout the survey area (Figure 26). This banding corresponded to variations of density and chemical composition within fill deposits. The profile also indicated a change in reflectivity that occurred around 0.15 mbs. An anomaly was observed in the profile and corresponded to the utility pipes spanning through the center of the excavation. The maximum depth of clean signal return was approximately 1.0 mbs.

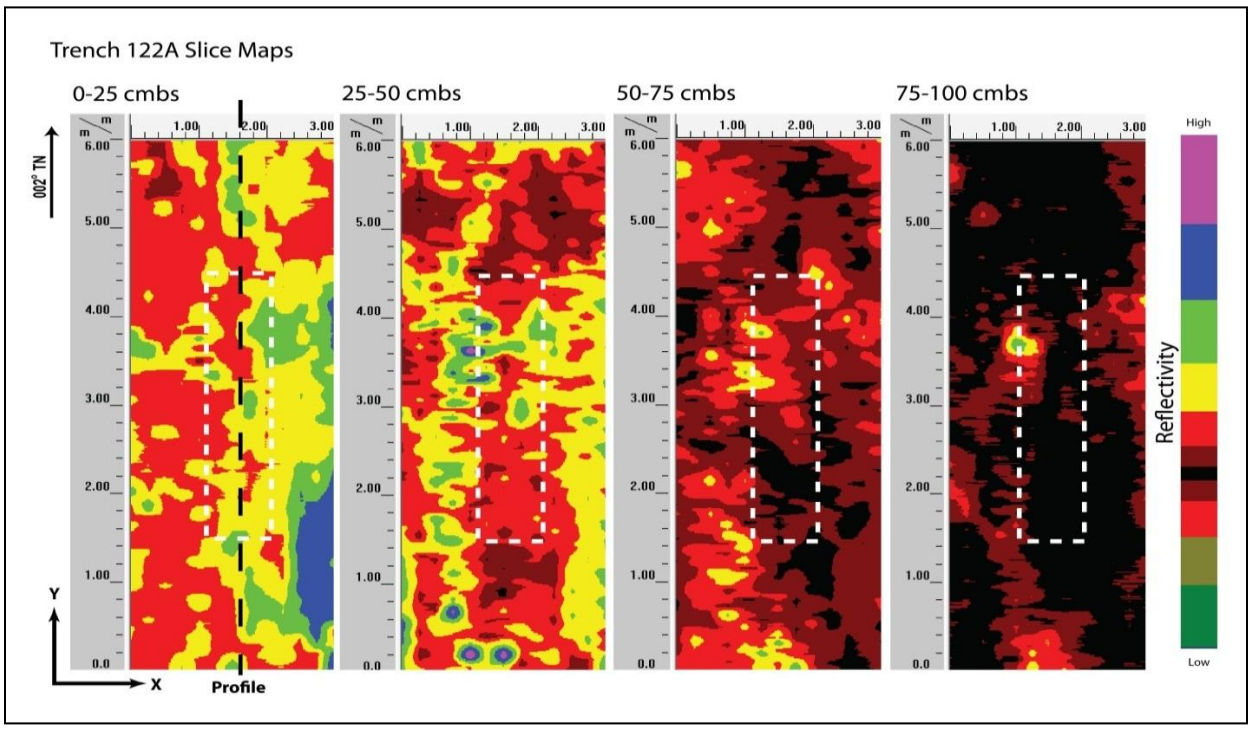

Figure 25. Slice maps of T-122A at 25cm depth intervals

A visual comparison of the excavated profile and the GPR signal profile showed a strong correlation in stratigraphic transitions (Figure 26). Strata Ia and Ib were clearly observed and occured near the ground-truthed depths. Strata included a layer of concrete on top of base course. Several utilities were found during excavation. The anomaly observed in the profile corresponded to several metal utilities pipes that were found 0.56 mbs. No other discrete objects or stratigraphic transitions were observed in the GPR results or subsequent excavation.

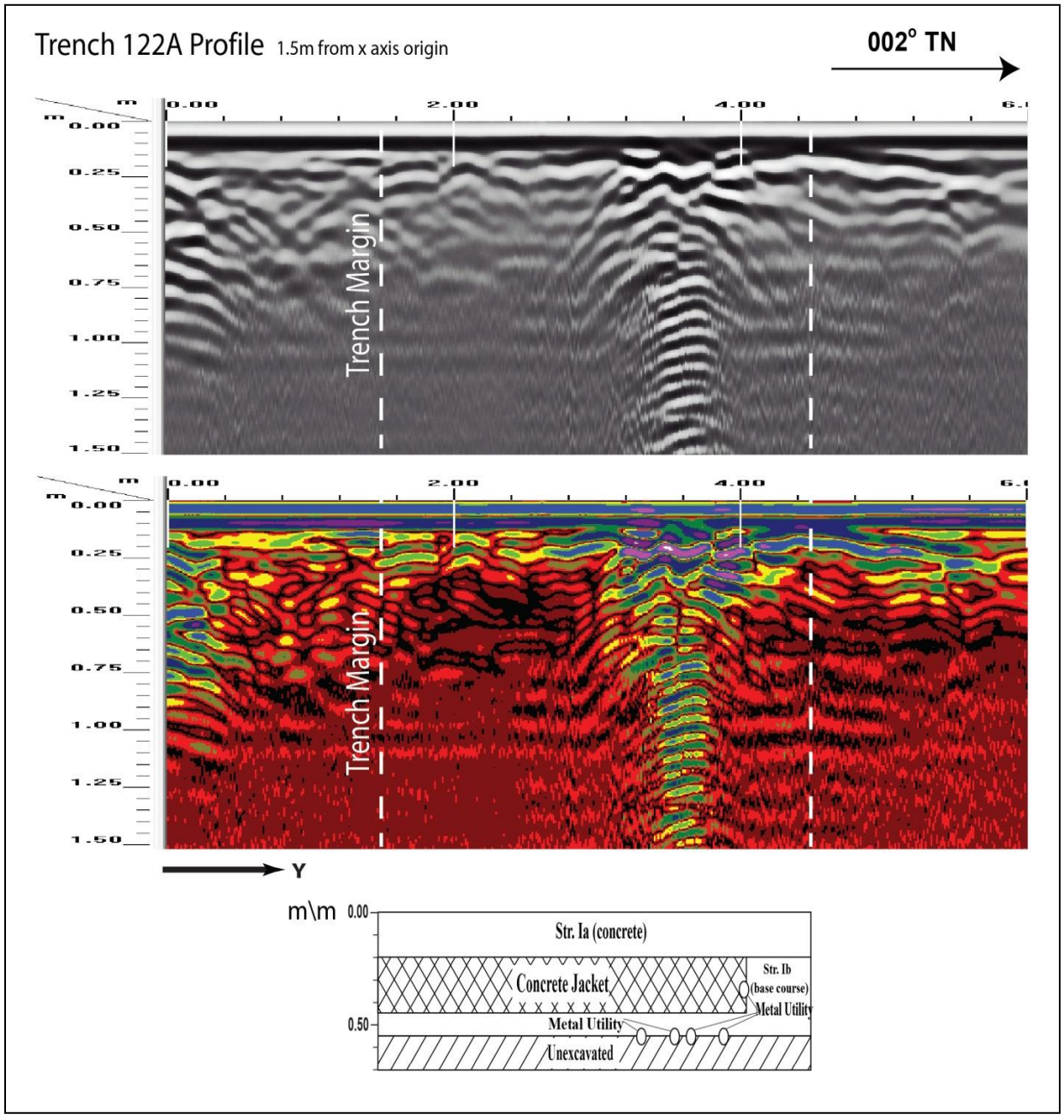

Figure 26. Visual comparison of excavated profile and GPR signal profile of T-122A

Test Excavation 123

T-123 measured 0.9 m by 3.0 m and was oriented northwest to southeast and was located within the road cut of Halekauwila Street, 65.0 m southeast of Halekauwila Street and Punchbowl Street intersection. The GPR grid measured 2.5 m by 8.0 m with 0.25 m spacing between Y transects and 1.0 m spacing between X transects. Utilities located near the excavation include: water line 0.7 m southwest, electrical line 0.9 m northeast, and sewer line 1.1 m northwest. The end portion of a 12.0 cm utility pipe was encountered 0.9 mbs in the northern end of the excavation.

A review of amplitude slice maps indicated no linear features which might indicate the presence of utilities although the end of a utility was encountered during excavation. Reflectivity was relatively uniform throughout the grid and decreased with depth. A transition from higher reflectivity to lower reflectivity was observed at approximately 0.75 mbs (Figure 27).

GPR depth profiles for T-123 identified horizontal banding, commonly associated with stratigraphic layering, throughout the survey area (Figure 28). This banding corresponded to variations of density and chemical composition within fill deposits. The profile also indicated a change in reflectivity that occurred around 0.5 mbs. Several anomalies were observed in the profile and one corresponded to the utility encountered during excavation. The maximum depth of clean signal return was approximately 1.0 mbs.

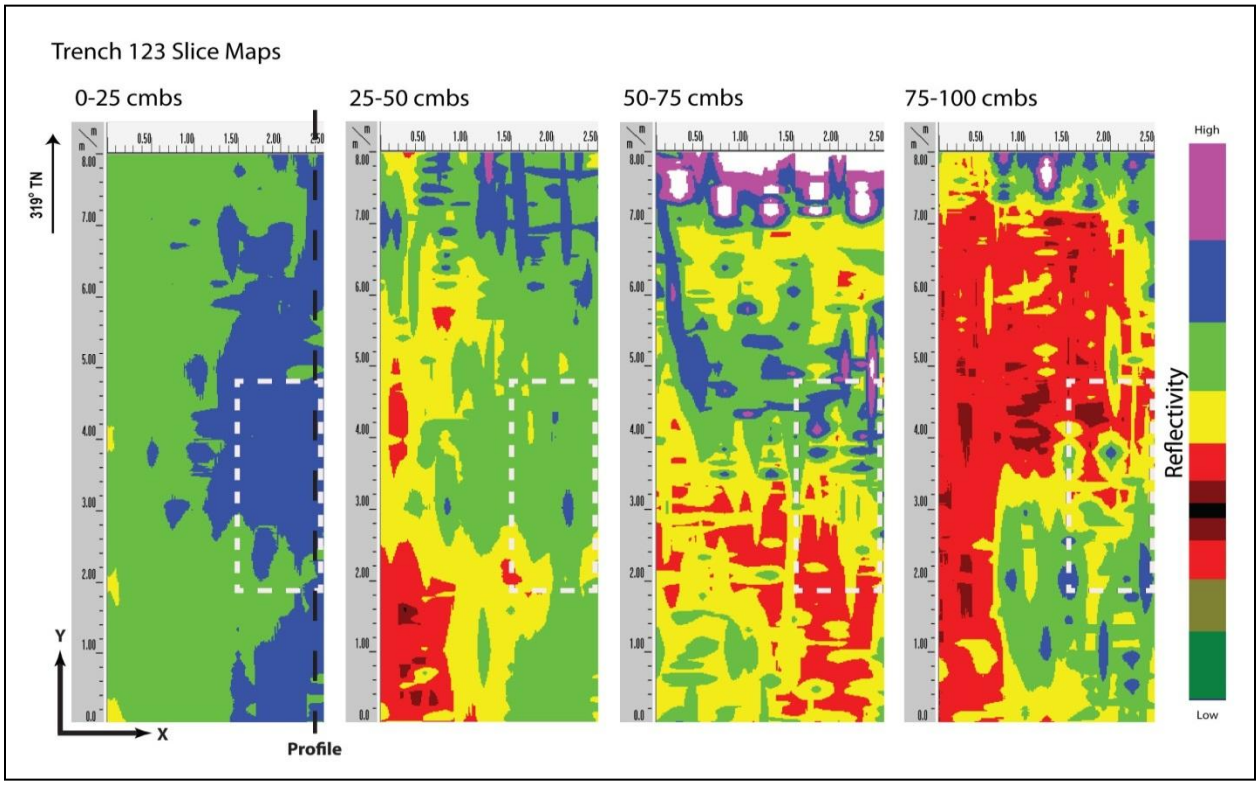

Figure 27. Slice maps of T-123 at 25cm depth intervals.

A visual comparison of the excavated profile and the GPR signal profile showed a moderate correlation in stratigraphic transitions (Figure 28). Strata Ia to Ib were clearly observed and occured at the ground-truthed depths.A pipe was found 0.9 mbs. An anomaly was observed in the profile that seems to corresponded to the utility pipe. No other discrete were observed in the GPR results or subsequent excavation.

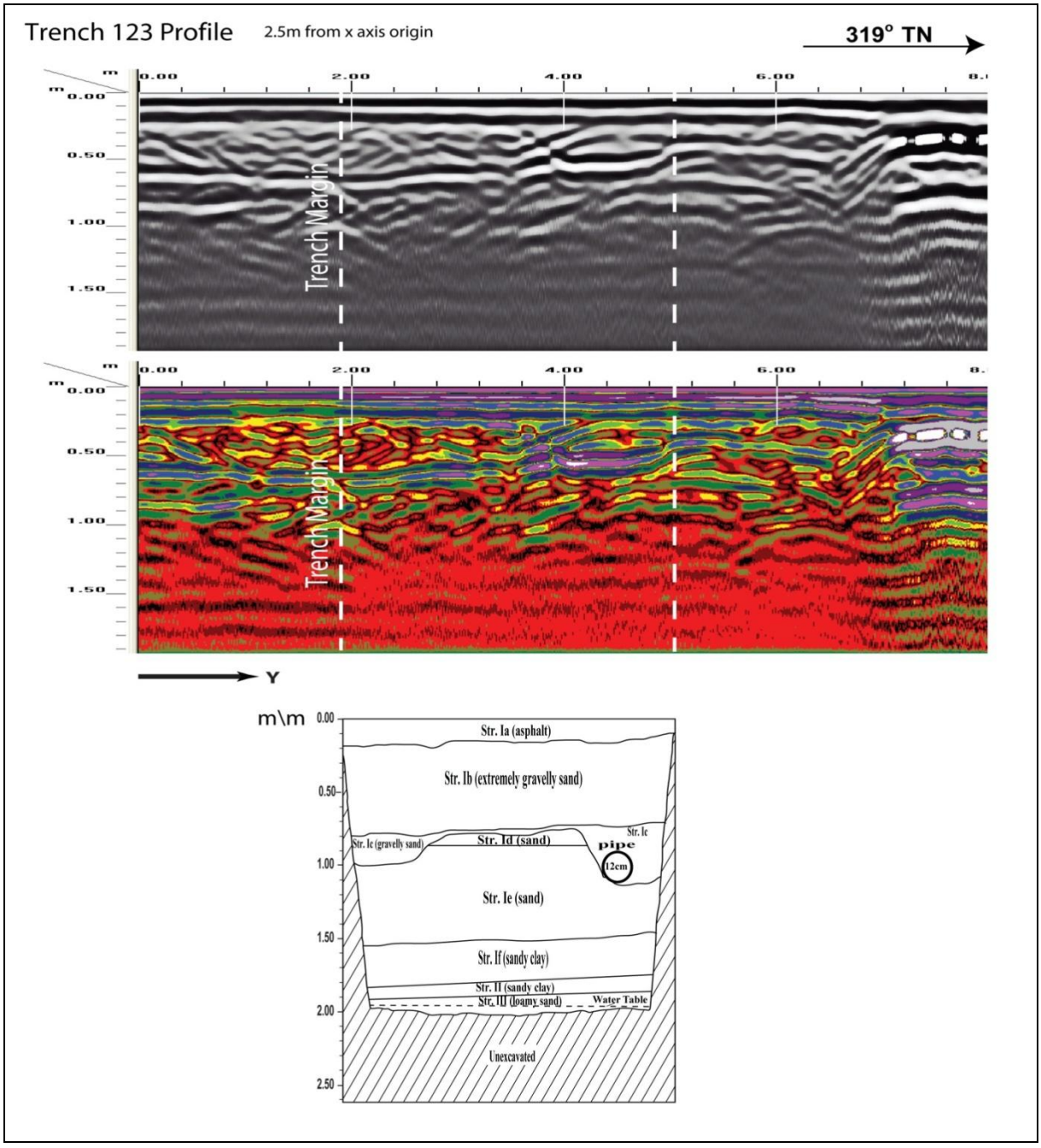

Figure 28. Visual comparison of excavated profile and GPR signal profile of T-123

Test Excavation 124

T-124 measured 0.6 m by 6.0 m and was oriented northwest to southeast and was located within the road cut of Halekauwila Street, between South Street and Punchbowl Street intersection, fronting Lawyers Building. The GPR grid measured 2.5 m by 10.0 m with 0.25 m spacing between Y transects and 1.0 m spacing between X transects. Utilities located near the excavation include: electrical line 0.8 m northeast, water line 1.0 m southwest. No utilities transected the excavation location.

A review of amplitude slice maps indicated no linear features which might indicate the presence of utilities. Reflectivity was relatively uniform throughout the grid. A transition from higher reflectivity to lower reflectivity was observed at approximately 0.75 mbs (Figure 29).

GPR depth profiles for T-124 identified horizontal banding, commonly associated with stratigraphic layering, throughout the survey area (Figure 30). This banding corresponded to variations of density and chemical composition within fill deposits. The profile also indicated a change in reflectivity that occurred around 0.2 mbs. No utilities were observed in the profile. The maximum depth of clean signal return was approximately 1.0 mbs.

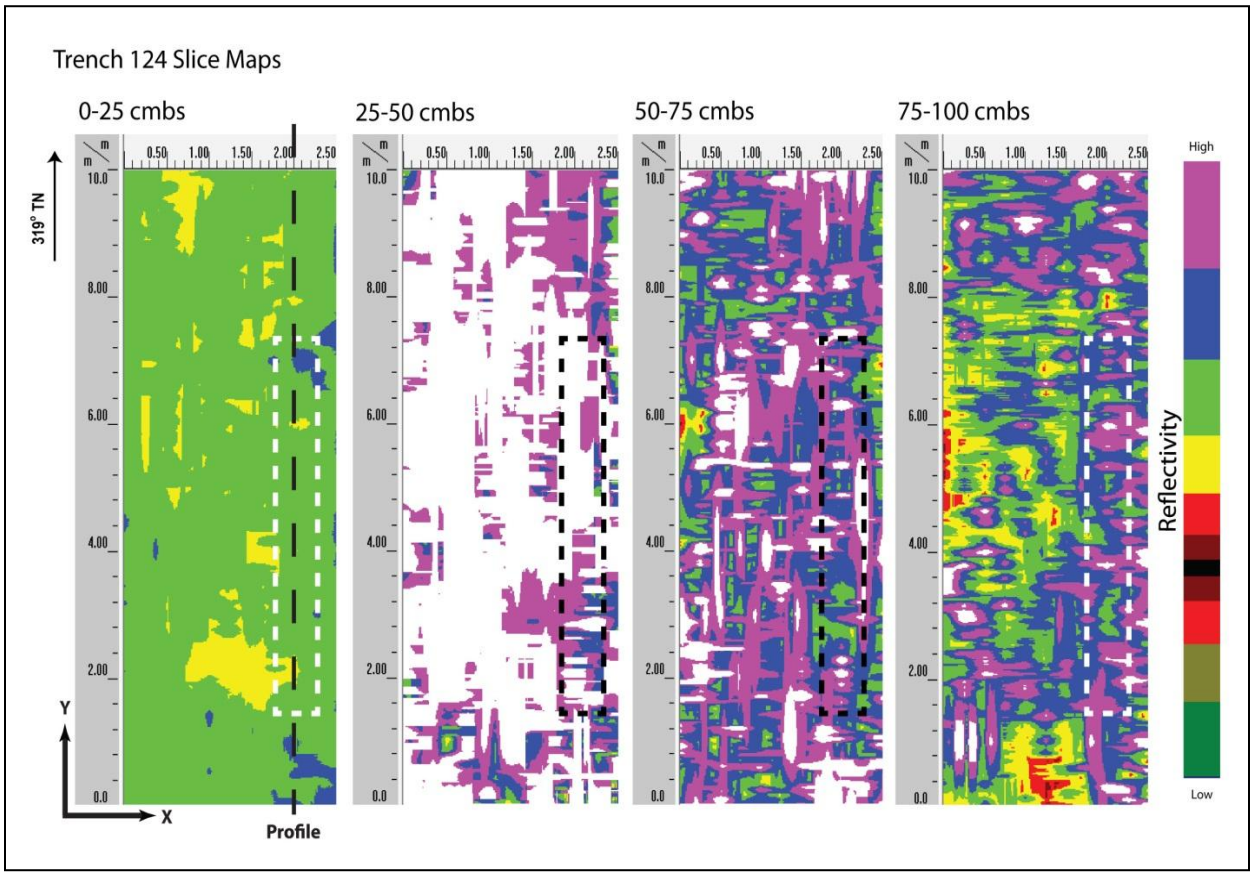

Figure 29. Slice maps of T-124 at 25cm depth intervals

A visual comparison of the excavated profile and the GPR signal profile showed a weak correlation in stratigraphic transitions (Figure 30). Strata included: asphalt, extremely gravelly sandy loam fill, very gravelly sand, sandy loam fill, natural sandy loam, natural loamy sand, natural sand, natural clay loam, and natural sandy loam. These transitions were not clearly depicted in the GPR profile at the depths that they occured. No other sediment transitions or discrete objects were observed in the GPR results or subsequent excavation.

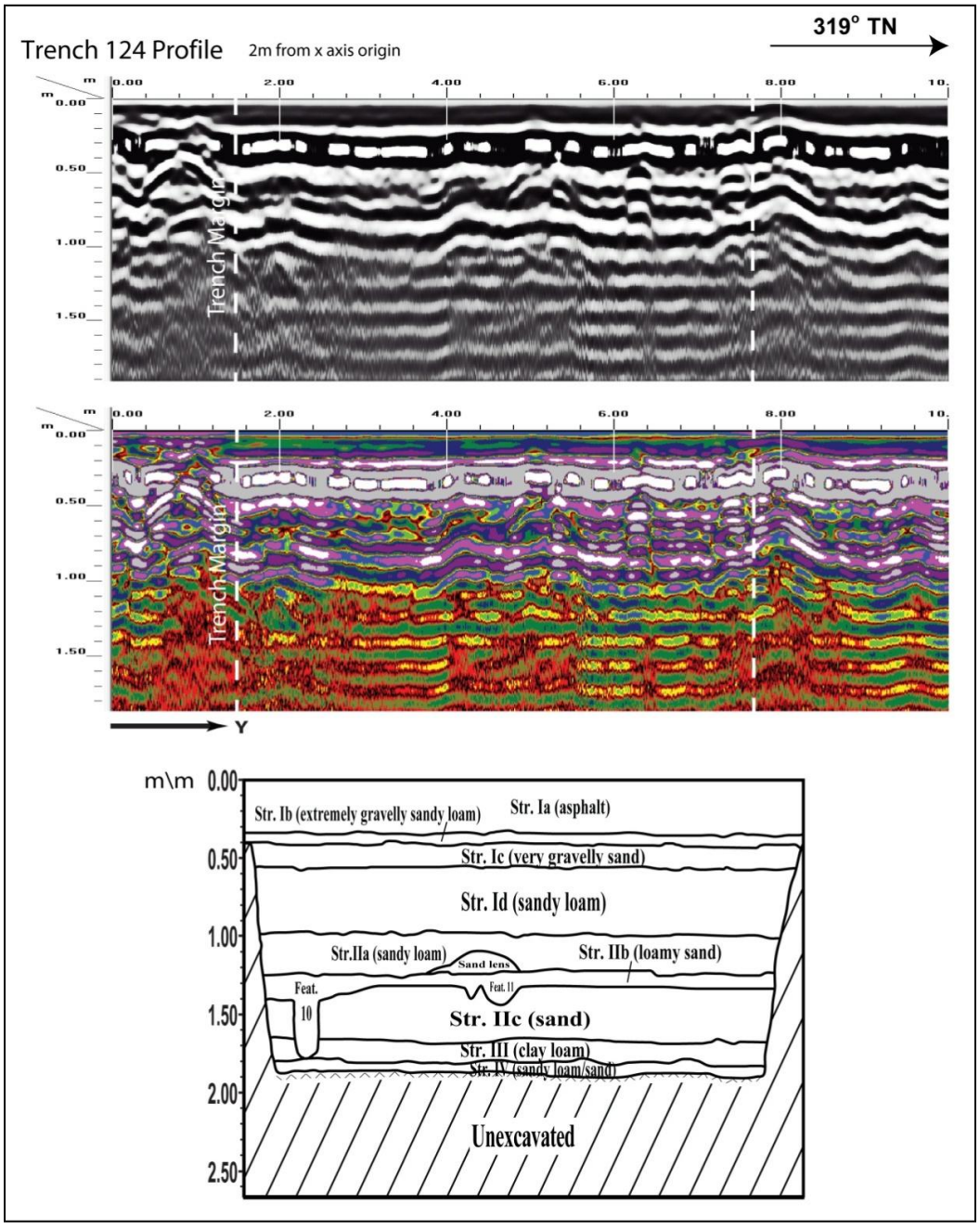

Figure 30. Visual comparison of excavated profile and GPR signal profile of T-124

Test Excavation 125

T-125 measured 0.6 m by 6.0 m and was oriented northwest to southeast and was located within the road cut of Halekauwila Street, 55.0 m northwest of South Street and fronting Max & Lucy’s. The GPR grid measured 2.5 m by 10.0 m with 0.25 m spacing between Y transects and 1.0 m spacing between X transects. Utilities located near the excavation include: water line 0.5 m southwest, electrical line 0.75 m northeast and 0.75 m northwest, and sewer line 0.75 m southeast. No utilities transected the GPR grid or excavation location.

A review of amplitude slice maps indicated no linear features which might indicate the presence of utilities. Reflectivity was relatively uniform throughout the grid. A transition from higher reflectivity to lower reflectivity was observed at approximately 0.75 mbs (Figure 31).

GPR depth profiles for T-125 identified horizontal banding, commonly associated with stratigraphic layering, throughout the survey area (Figure 32). This banding corresponded to variations of density and chemical composition within fill deposits. The profile also indicated a change in reflectivity that occurred around 0.25 mbs. No utilities were observed in the profile. The maximum depth of clean signal return was approximately 1.0 mbs.

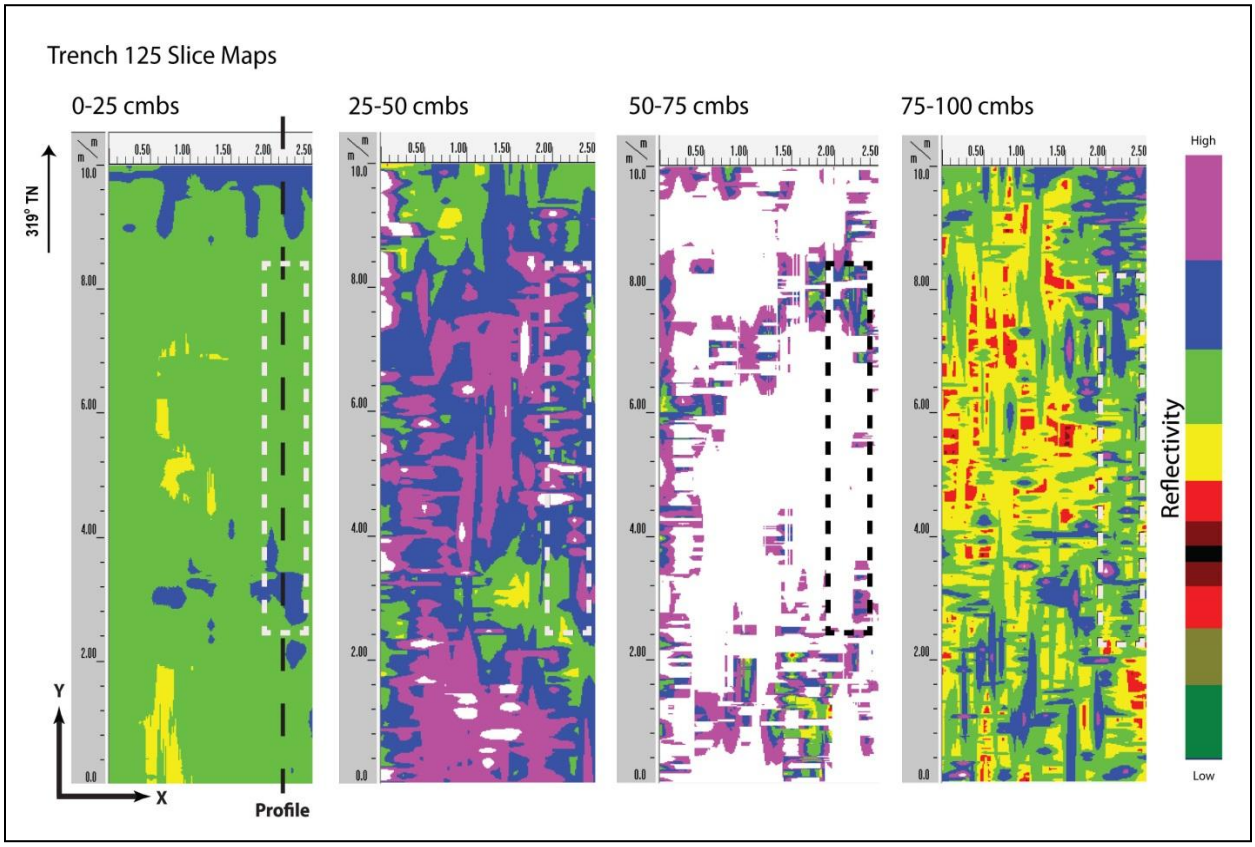

Figure 31. Slice maps of T-125 at 25cm depth intervals

A visual comparison of the excavated profile and the GPR signal profile showed a weak correlation in stratigraphic transitions (Figure 32). Strata included: asphalt, gravelly sandy loam fill, extremely gravelly silt fill, gravelly silt loam fill, extremely gravelly to stony sand fill. These transitions were not clearly depicted in the GPR profile at the depths that they occured. A concrete pad remnant was found 1.0 mbs but was not observed in the profile because it was at the maximum depth of clean signal return. No other sediment transitions or discrete objects were observed in the GPR results or subsequent excavation.

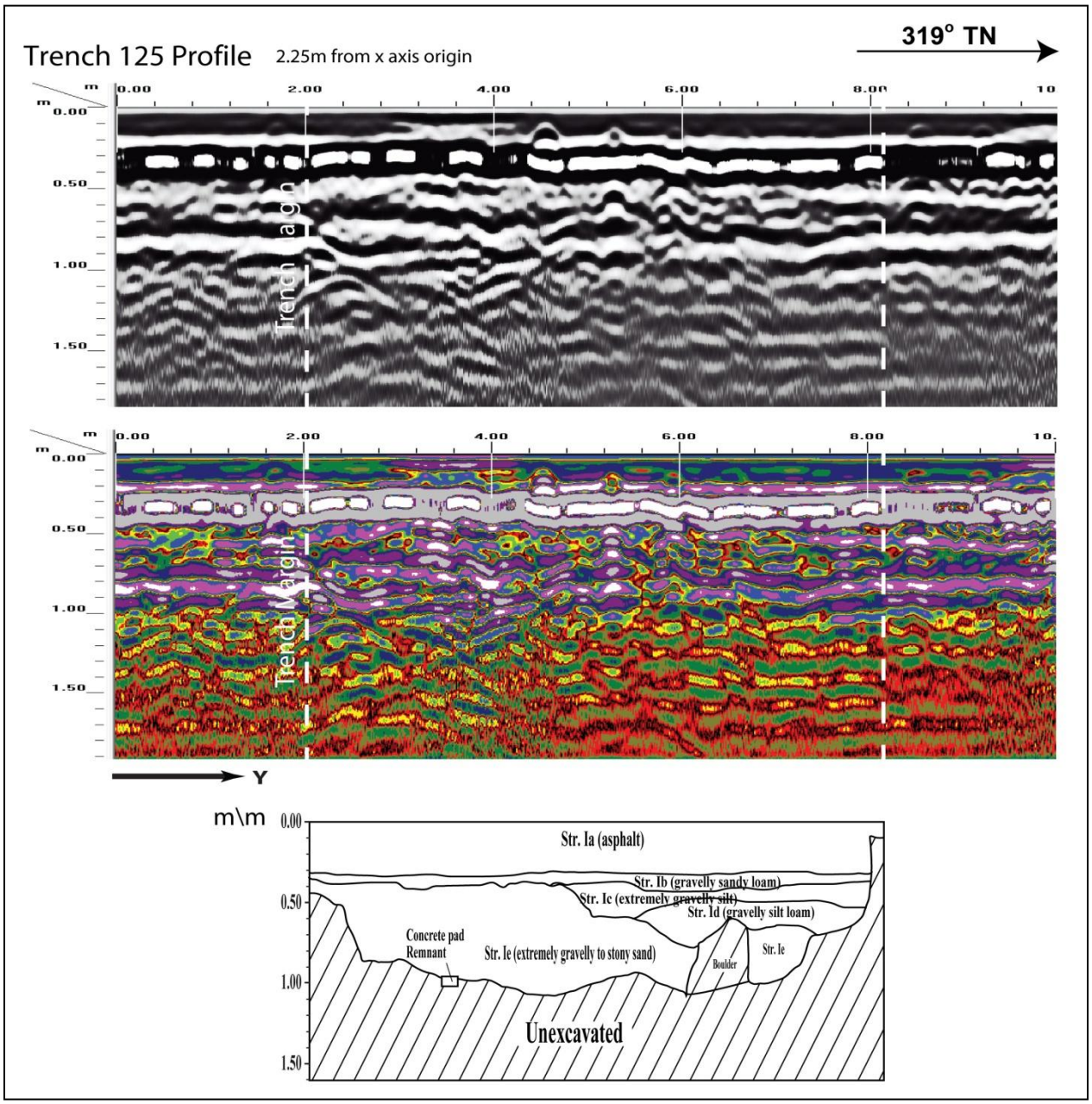

Figure 32. Visual comparison of excavated profile and GPR signal profile of T-125

Test Excavation 126

T-126 measured 0.6 m by 6.0 m and was oriented northwest to southeast and was located on the southwest sidewalk on Halekauwila Street, 30.0 m northwest of Halekauwila Street and South Street intersection. The GPR grid measured 2.0 m by 10.0 m with 0.25 m spacing between Y transects and 1.0 m spacing between X transects. Utilities located near the excavation include: electrical line within the excavation and 0.5 m east, water line 3.2 m east. No utilities transected the excavation location.

A review of amplitude slice maps indicated a linear feature but not within the excavation location. Reflectivity was relatively uniform throughout the grid and decreased with depth except for the linear feature. A transition from higher reflectivity to lower reflectivity was observed at approximately 0.5 mbs (Figure 33).

GPR depth profiles for T-126 identified horizontal banding, commonly associated with stratigraphic layering, throughout the survey area (Figure 34). This banding corresponded to variations of density and chemical composition within fill deposits. The profile also indicated a change in reflectivity that occurred around 0.15 mbs. A small anomaly was observed in the profile and could corresponded to the large piece of concrete that was encountered during excavation. The maximum depth of clean signal return was approximately 0.9 mbs.

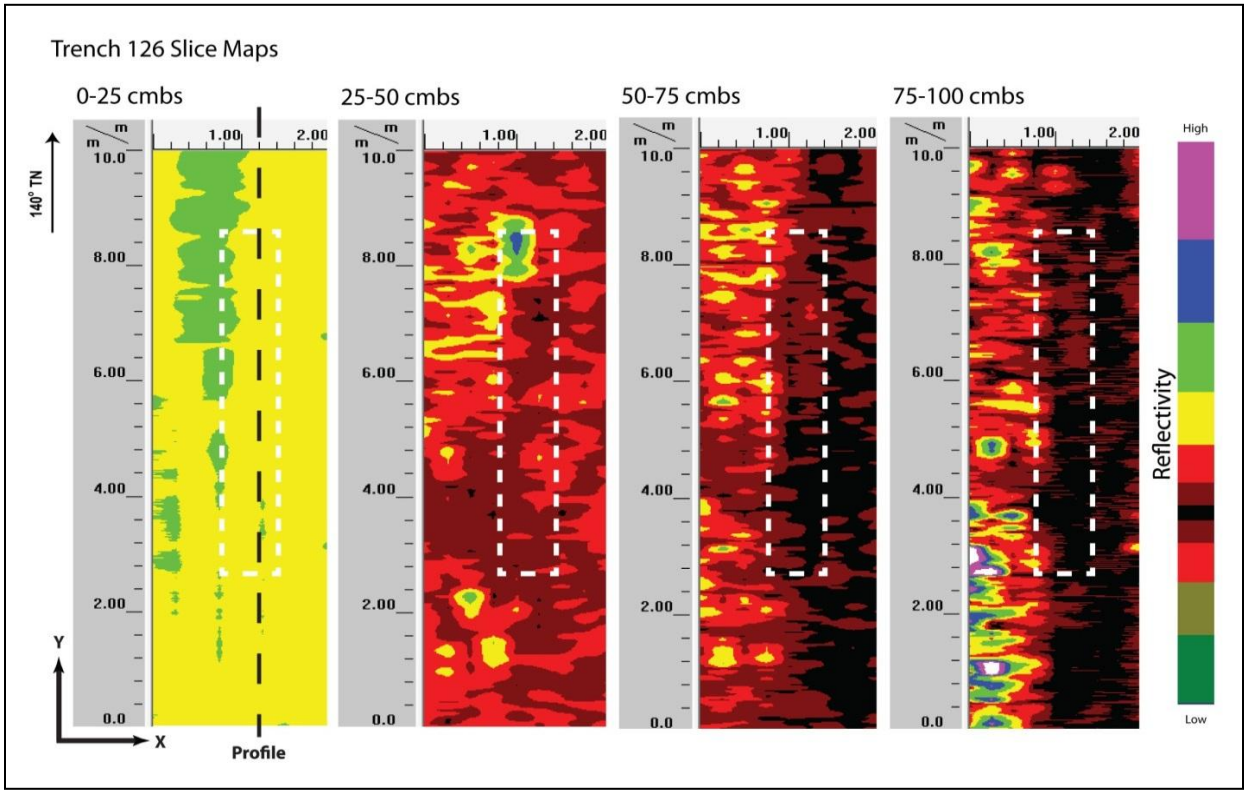

Figure 33. Slice maps of T-126 at 25cm depth intervals

A visual comparison of the excavated profile and the GPR signal profile showed a strong correlation in stratigraphic transitions (Figure 34). Strata Ia and Ic were clearly observed and occured at the ground-truthed depths. Textural changes in the form of multiple small hyperbolas were apparent in Stratum Ic which was very gravelly loam fill. A large piece of concrete was found 0.85 mbs. This concrete piece seemed to corresponded to a slight anomaly observed in the profile before the signal was lost. All other sediment transitions were below the maximum depth of clean signal return. No other discrete objects were observed in the GPR results or subsequent excavation.

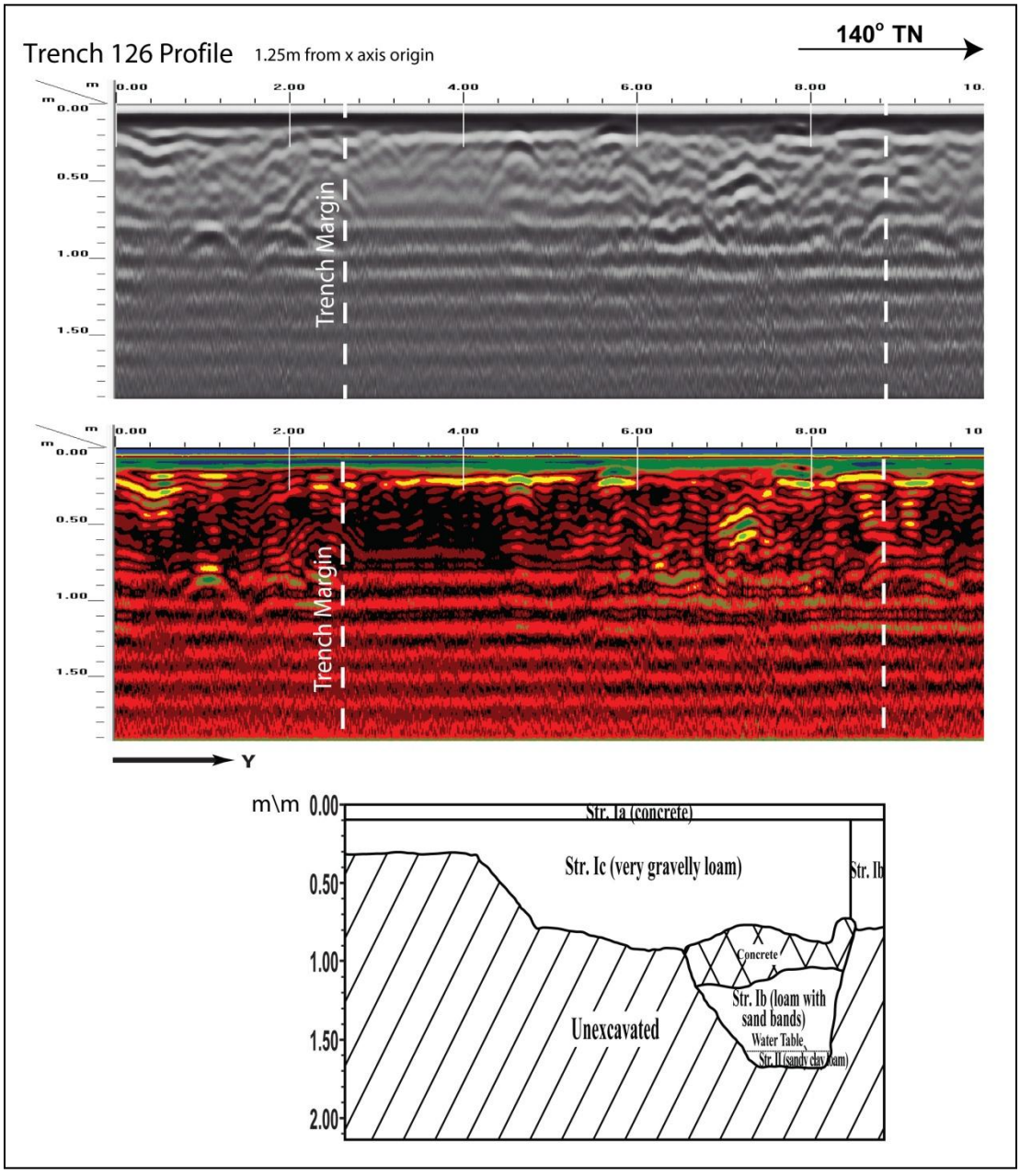

Figure 34. Visual comparison of excavated profile and GPR signal profile of T-126

Test Excavation 127

T-127 measured 0.9 m by 3.0 m and was oriented northeast to southwest and was located within a decorated median, 3.3 m northeast of Halekauwila Street, 14 m north of Halekauwila Street and South Street intersection. The GPR grid measured 2.5 m by 5.0 m with 0.25 m spacing between Y transects and 1.0 m spacing between X transects. Utilities located near the excavation include: electrical line 1.4 m southwest, sewer line 1.8 m southwest. Several 1” water lines were encountered 0.24 mbs in the northeast end of the excavation.

A review of amplitude slice maps indicated no linear features although three water lines were encountered during excavation. Reflectivity was relatively uniform throughout the grid and decreased with depth. A transition from higher reflectivity to lower reflectivity was observed at approximately 0.25 mbs (Figure 35).

GPR depth profiles for T-127 identified horizontal banding, commonly associated with stratigraphic layering, throughout the survey area (Figure 36). This banding corresponded to variations of density and chemical composition within fill deposits. The profile also indicated a change in reflectivity that occurred around 0.2 mbs. No utilities were observed in the profile although three water lines were encountered during excavation. The maximum depth of clean signal return was approximately 1.0 mbs.

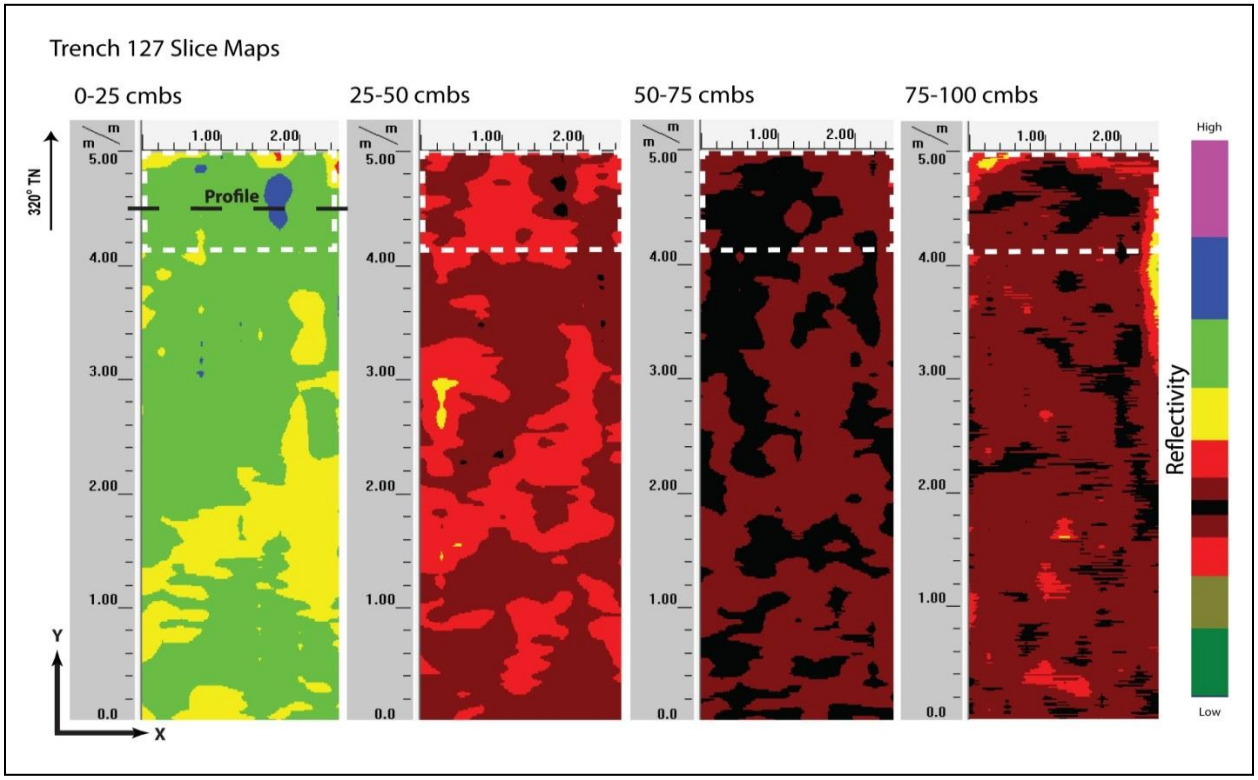

Figure 35. Slice maps of T-127 at 25cm depth intervals

A visual comparison of the excavated profile and the GPR signal profile showed a strong correlation in stratigraphic transitions (Figure 36). Strata Ia to Ic were clearly observed and occured at the ground-truthed depths. Three water lines were found 0.24 mbs. These water lines did not showed up on the profile or slice maps. This may be due to the fact that the pipes were comprised of PVC or that the pipes were empty. No other discrete objects were observed in the GPR results or subsequent excavation.

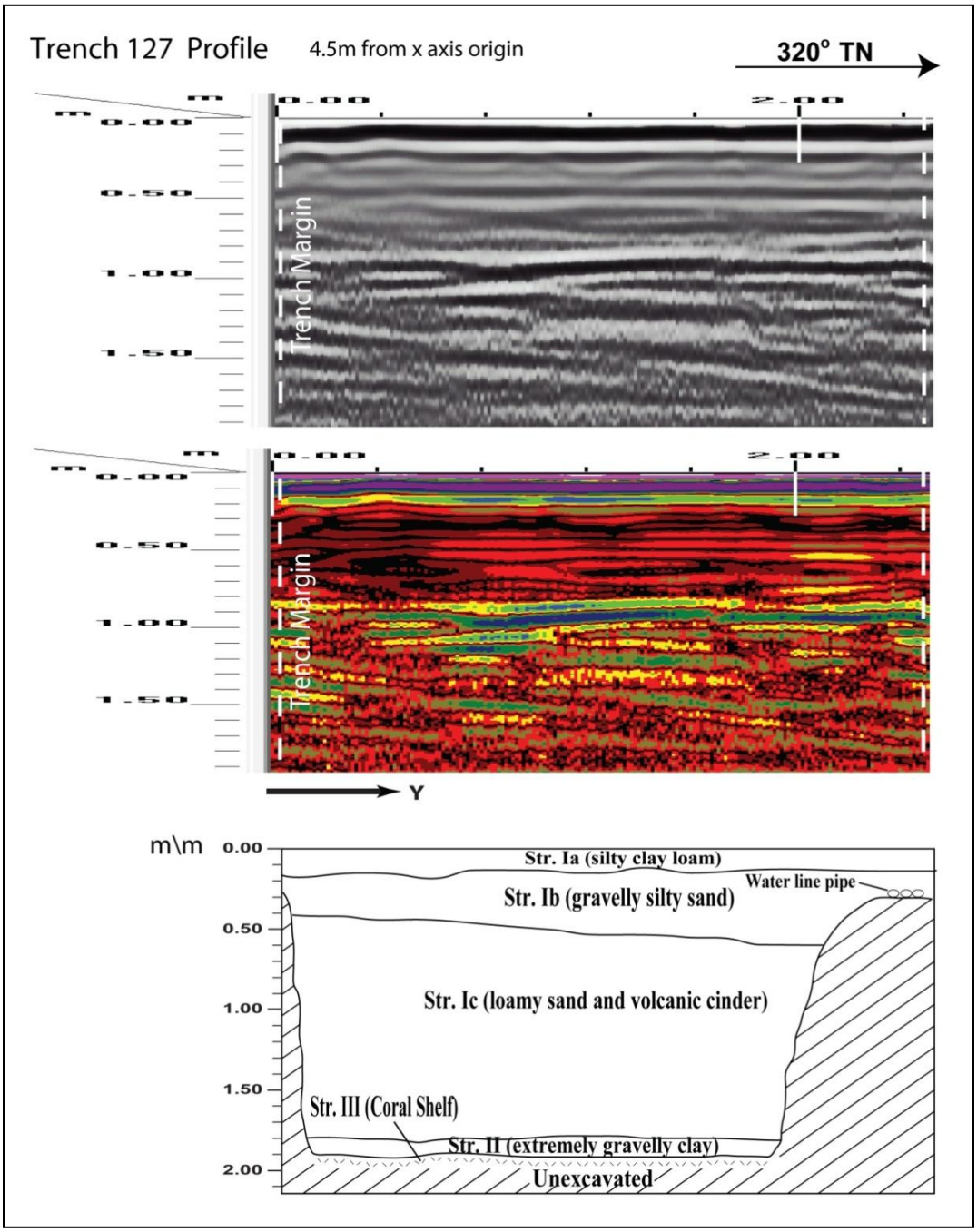

Figure 36. Visual comparison of excavated profile and GPR signal profile of T-127

Test Excavation 128

T-128 measured 0.6 m by 6.0 m and was oriented northwest to southeast and was located within grassy median approximately 2.0 m southwest of the sidewalk on Halekauwila Street, 18.0 m south of Halekauwila Street and South Street intersection. The GPR grid measured 3.0 m by 5.0 m with 0.25 m spacing between Y transects and 1.0 m spacing between X transects. Utilities located near the excavation include: gas line 0.9 m northeast, electrical line 3.2 m northeast, and water line 6.5 m northeast. A utility jacket was encountered 0.4 mbs and 2 electrical utilities were encountered 0.45 mbs in the center and towards the north end of the excavation.

A review of amplitude slice maps indicated a linear which corresponded to the utility jacket and electrical line encountered during excavation. Reflectivity was relatively uniform throughout the grid. A transition from higher reflectivity to lower reflectivity was observed at approximately 0.5 mbs (Figure 37).

GPR depth profiles for T-128 identified horizontal banding, commonly associated with stratigraphic layering, throughout the survey area (Figure 38). This banding corresponded to variations of density and chemical composition within fill deposits. The profile also indicated a change in reflectivity that occurred around 0.3 mbs. Several anomalies were observed in the profile and seem to corresponded to the utility jacket and electrical lines encountered during excavation. The maximum depth of clean signal return was approximately 1.0 mbs.

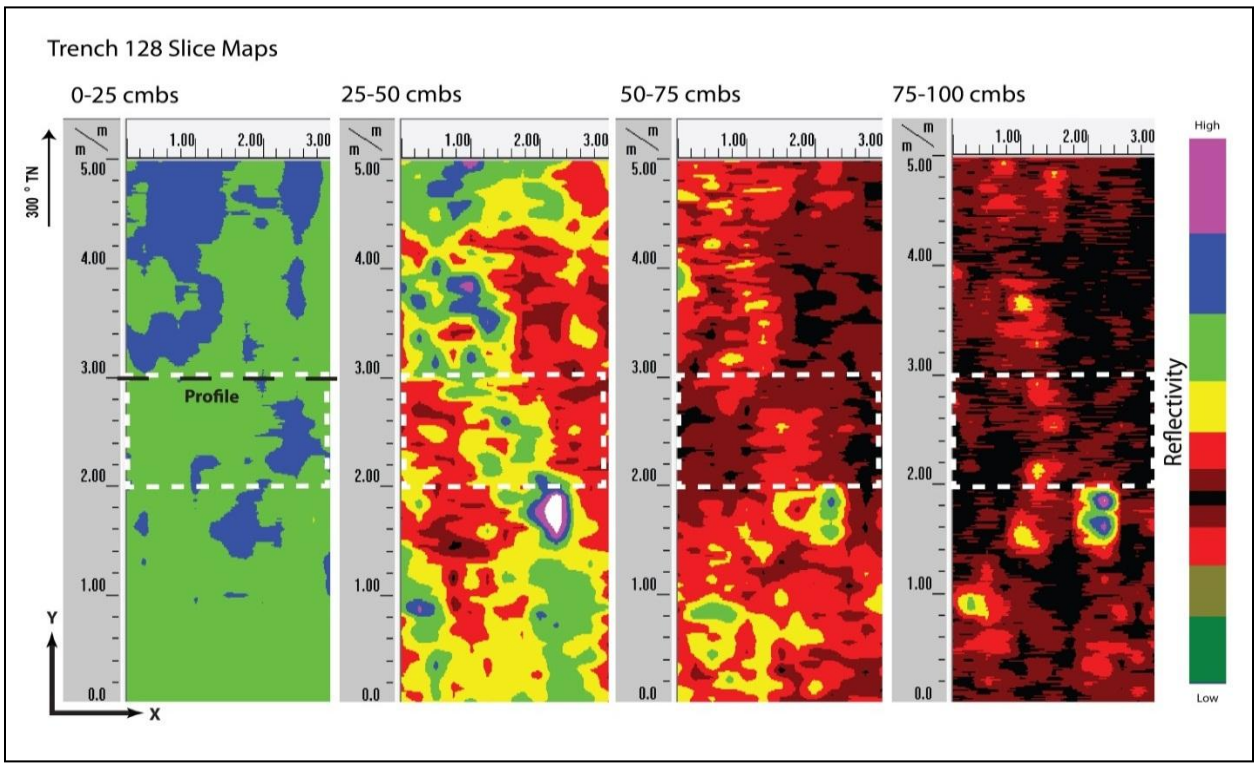

Figure 37. Slice maps of T-128 at 25cm depth intervals

A visual comparison of the excavated profile and the GPR signal profile showed a strong correlation in stratigraphic transitions (Figure 38). Stratum Ia was clearly observed and occurs at the ground-truthed depth. A utility jacket and eletrical lines were found 0.4 and 0.45 mbs, respectively. Several hyperbola anomalies in the profile corresponded to the utility jacket and the electrical lines found during excavation. No other discrete objects or stratigraphic transitions were observed in the GPR results or subsequent excavation.

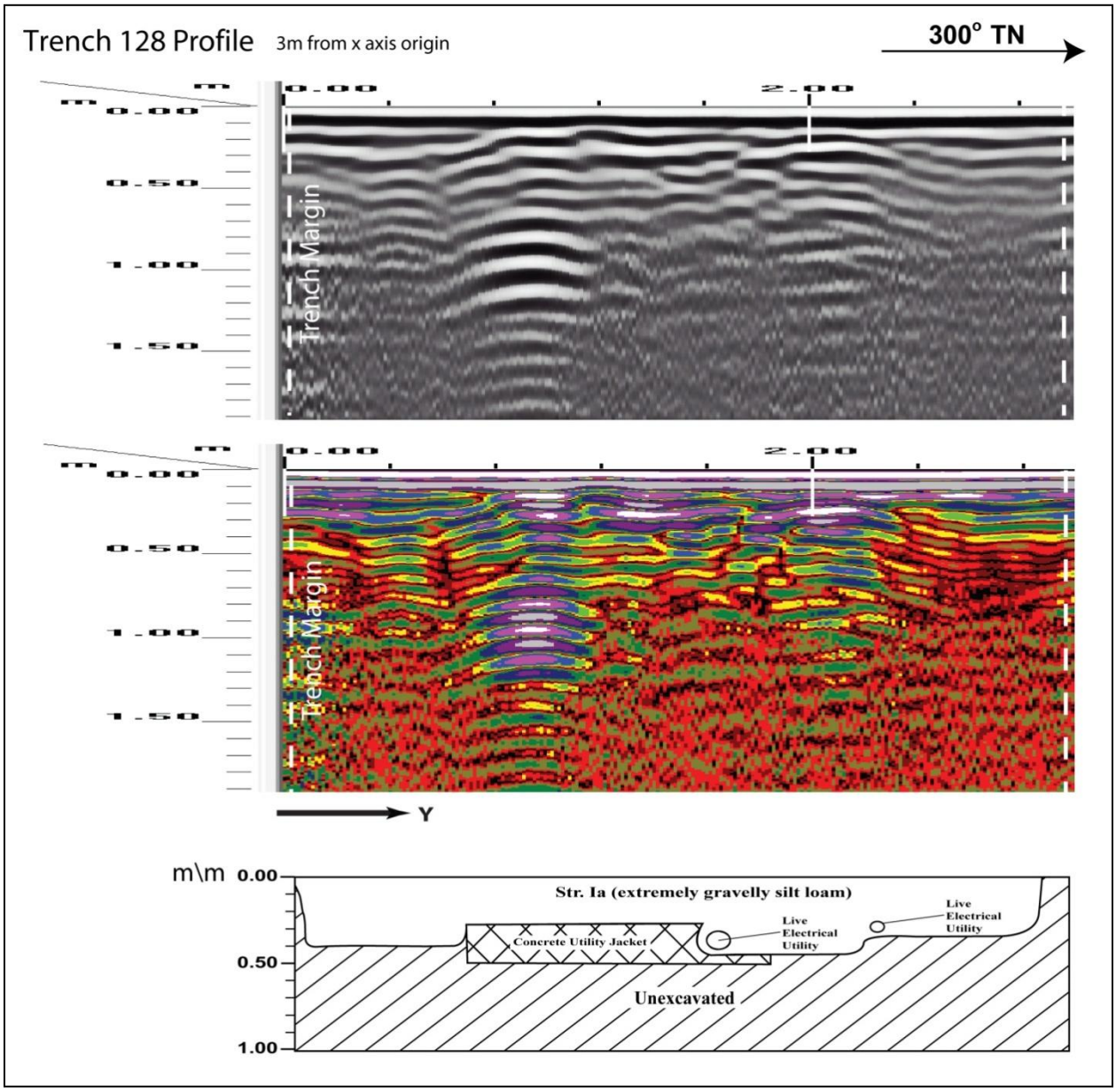

Figure 38. Visual comparison of excavated profile and GPR signal profile of T-128

Test Excavation 129

T-129 measured 0.9 m by 3.0 m and was oriented northwest to southeast and was located on the sidewalk of Halekauwila Street, 17 m southeast of Halekauwila Street and South Street intersection. The GPR grid measured 2.0 m by 6.0 m with 0.25 m spacing between Y transects and 1.0 m spacing between X transects. Utilities located near the excavation include: electrical cable within the excavation location. A PVC utility was encountered 0.8 mbs along the entire southwest side of the excavation.

A review of amplitude slice maps indicated no linear features althought a utility was encountered during excavation. Reflectivity was relatively uniform throughout the grid and decreased with depth. A transition from higher reflectivity to lower reflectivity was observed at approximately 0.25 mbs (Figure 39).

GPR depth profiles for T-129 identified horizontal banding, commonly associated with stratigraphic layering, throughout the survey area (Figure 40). This banding corresponded to variations of density and chemical composition within fill deposits. The profile also indicated a change in reflectivity that occurred around 0.2 mbs. No utilities were observed in the profile although a utility was encountered during excavation. The maximum depth of clean signal return was approximately 0.8 mbs.

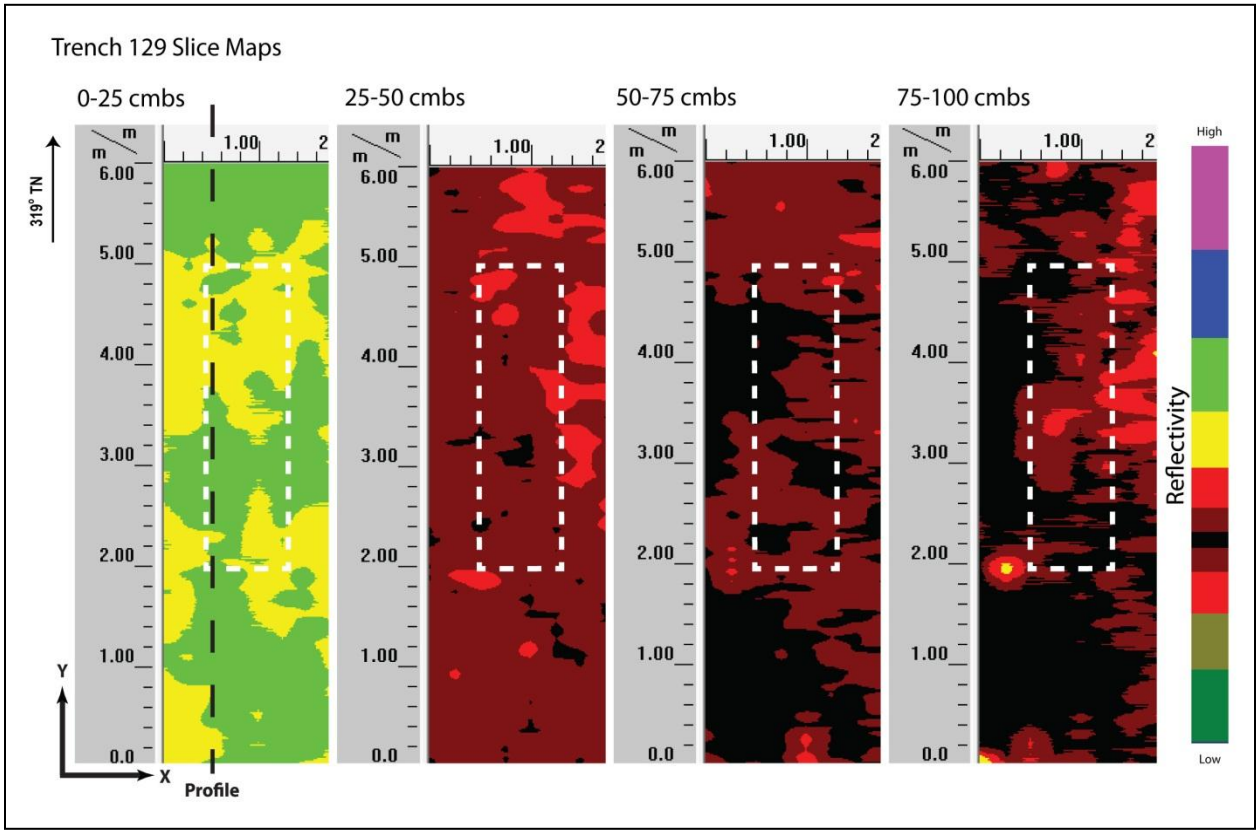

Figure 39. Slice maps of T-129 at 25cm depth intervals

A visual comparison of the excavated profile and the GPR signal profile showed a weak correlation in stratigraphic transitions (Figure 40). Strata included: concrete, very gravelly sandy loam fill, very gravelly sandy loam fill, extremely gravelly sand, extremely gravelly sand, silty clay fill, natural silty clay loam, and natural sandy clay. These transitions were not clearly depicted in the GPR profile at the depths that they occured. A PVC utility pipe was found 0.8 mbs. This utility pipe did not showed up on the profile or slice maps because it was at the maximum clean signal return depth. No other sediment transitions or discrete objects were observed in the GPR results or subsequent excavation.

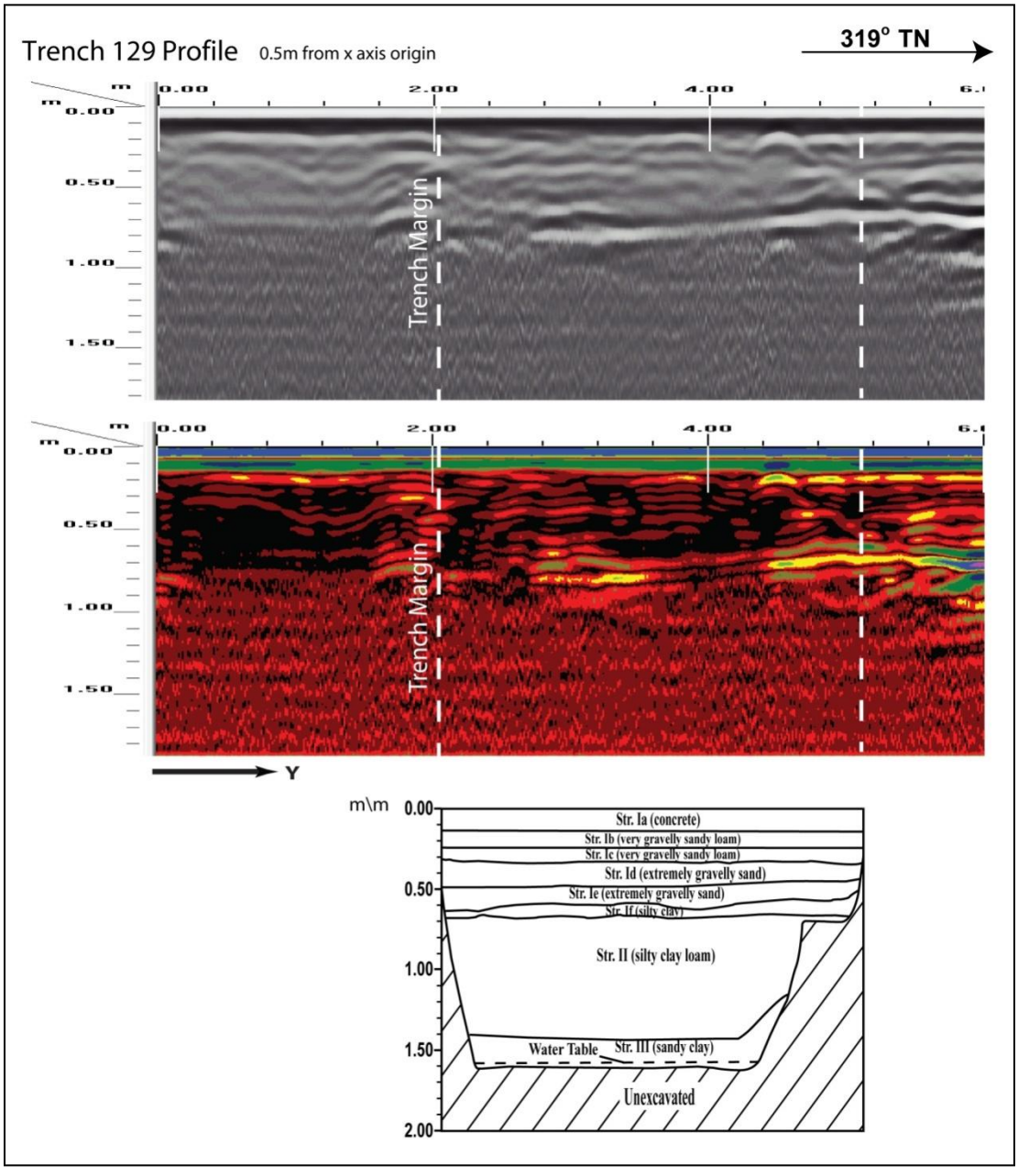

Figure 40. Visual comparison of excavated profile and GPR signal profile of T-129

Test Excavation 130

T-130 measured 0.6 m by 6.0 m and was oriented northeast to southwest and was located within a parking lot southwest of Halekauwila Street, 55.0 m northwest of Halekauwila Street and Keawe Street intersection. The GPR grid measured 3.0 m by 9.0 m with 0.25 m spacing between Y transects and 1.0 m spacing between X transects. Utilities located near the excavation include: gas line 5.3 m northeast, electrical cable 7.9 m northeast.

A review of amplitude slice maps indicated no linear features which might indicate the presence of utilities. Reflectivity was relatively uniform throughout the grid and decreased with depth. A transition from higher reflectivity to lower reflectivity was observed at approximately 0.5 mbs (Figure 41).

GPR depth profiles for T-130 identified horizontal banding, commonly associated with stratigraphic layering, throughout the survey area (Figure 42). This banding corresponded to variations of density and chemical composition within fill deposits. The profile also indicated a change in reflectivity that occurred around 0.25 mbs. No utilities were observed in the profile. The maximum depth of clean signal return was approximately 0.9 mbs.

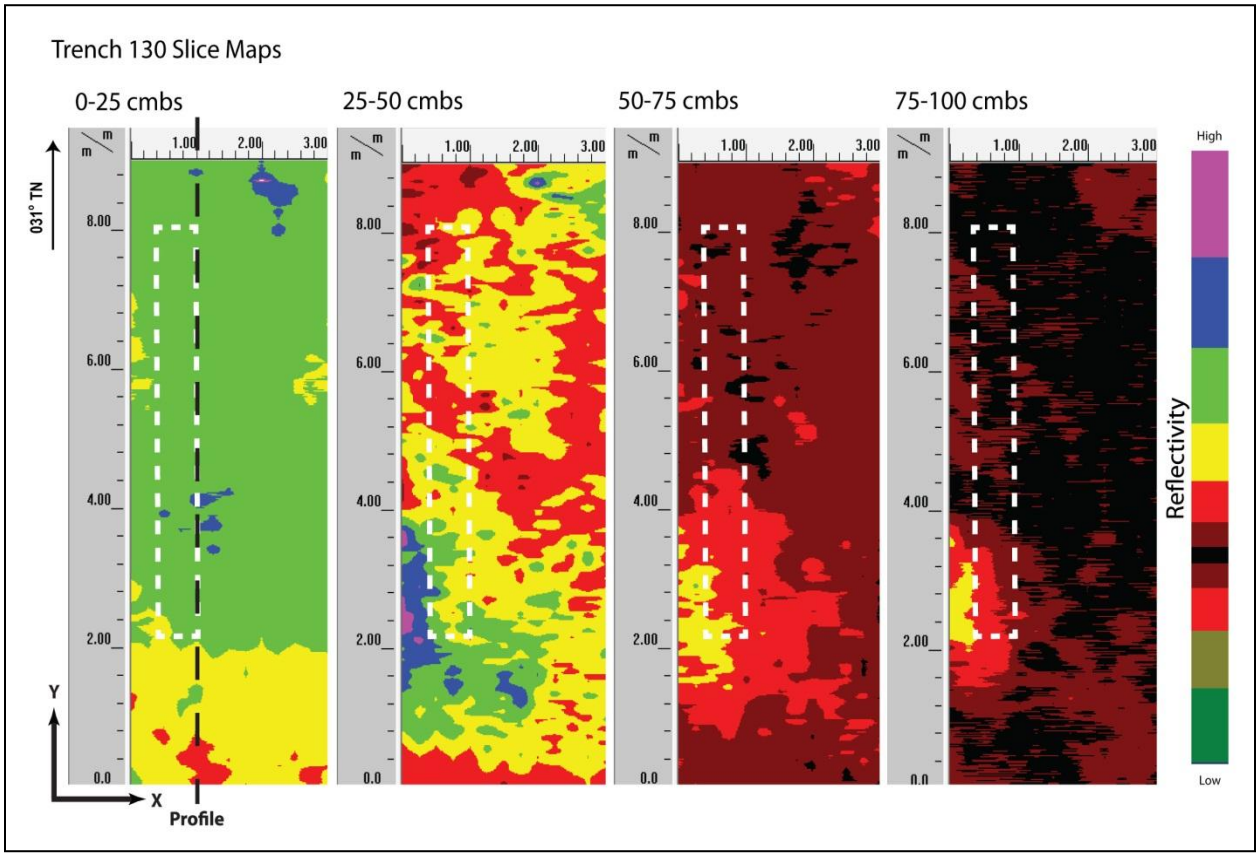

Figure 41. Slice maps of T-130 at 25cm depth intervals

A visual comparison of the excavated profile and the GPR signal profile showed a strong correlation in stratigraphic transitions (Figure 42). Strata Ia to Ih were clearly observed and occured at the ground-truthed depths. Strata Ia through Id were not individually discernible, possibly due to the fact that they were very thin layers of compacted fill, but based on reflectivity and horizontal banding it was apparent that there were multiple layers of fill events. All other sediment transitions were below the maximum depth of clean signal return. No discrete objects were observed in the GPR results or subsequent excavation.

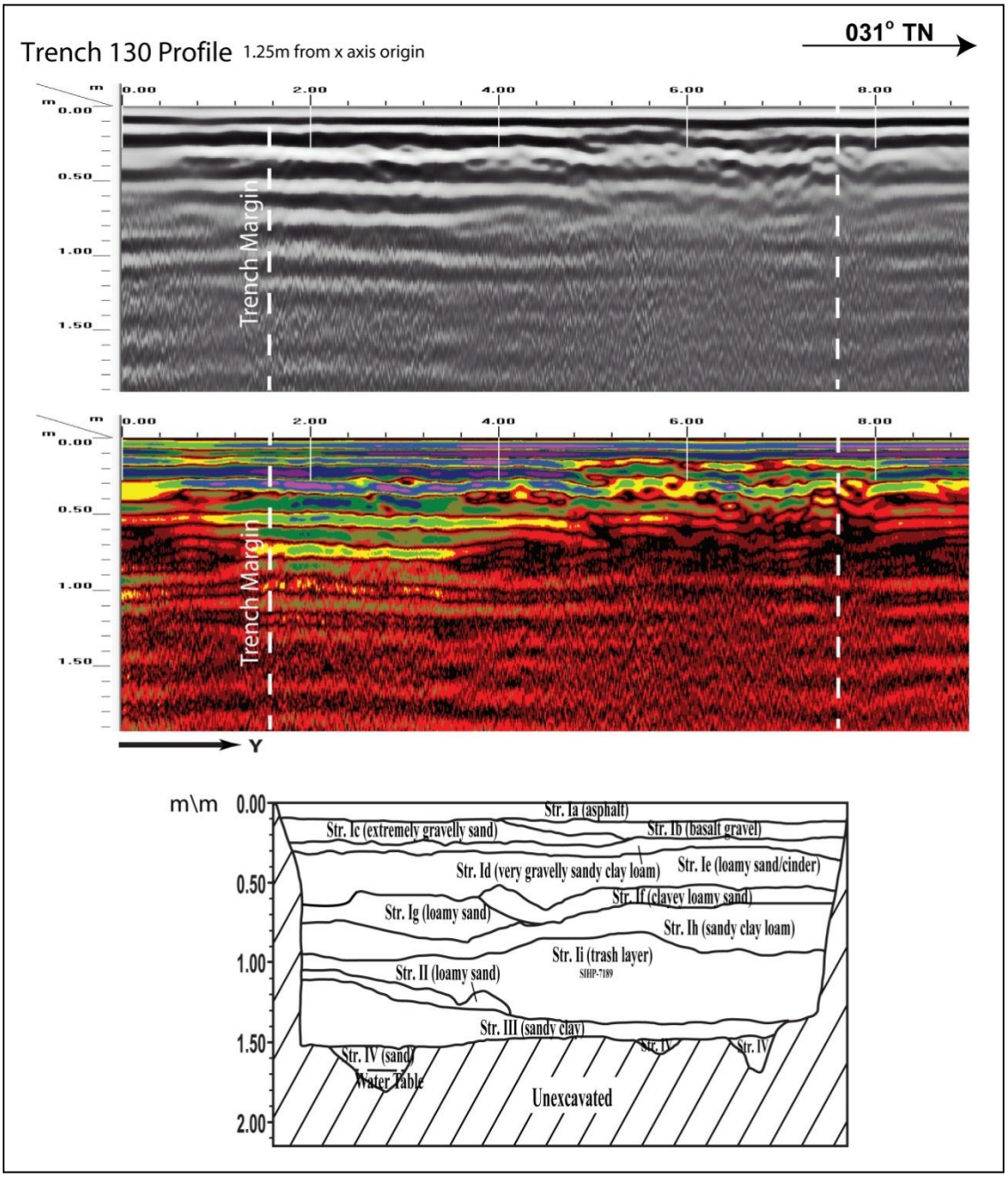

Figure 42. Visual comparison of excavated profile and GPR signal profile of T-130

Test Excavation 131

T-131 measured 0.9 m by 3.0 m and was oriented northwest to southeast and was located within the sidewalk northeast of Halekauwila Street, 55.0 m southeast of Halekauwila Street and South Street intersection. The GPR grid measured 2.0 m by 6.0 m with 0.25 m spacing between Y transects and 1.0 m spacing between X transects. Utilities located near the excavation include: telephone line 0.25 m southwest, electrical line 1 m southwest, and sewer line 3.9 m southwest. A concrete jacket was encountered 0.75 mbs on the southwestern side of the excavation.

A review of amplitude slice maps indicated a linear feature which corresponded to a storm drain adjacent to the excavation. Reflectivity was relatively uniform throughout the grid and decreased with depth except for the storm drain. A transition from higher reflectivity to lower reflectivity was observed at approximately 0.5 mbs (Figure 43).

GPR depth profiles for T-131 identified horizontal banding, commonly associated with stratigraphic layering, throughout the survey area (Figure 44). This banding corresponded to variations of density and chemical composition within fill deposits. The profile also indicated a change in reflectivity that occurred around 0.25 mbs. An anomaly was observed in the profile that corresponded to the storm drain adjacent to the excavation. The maximum depth of clean signal return was approximately 0.8 mbs.

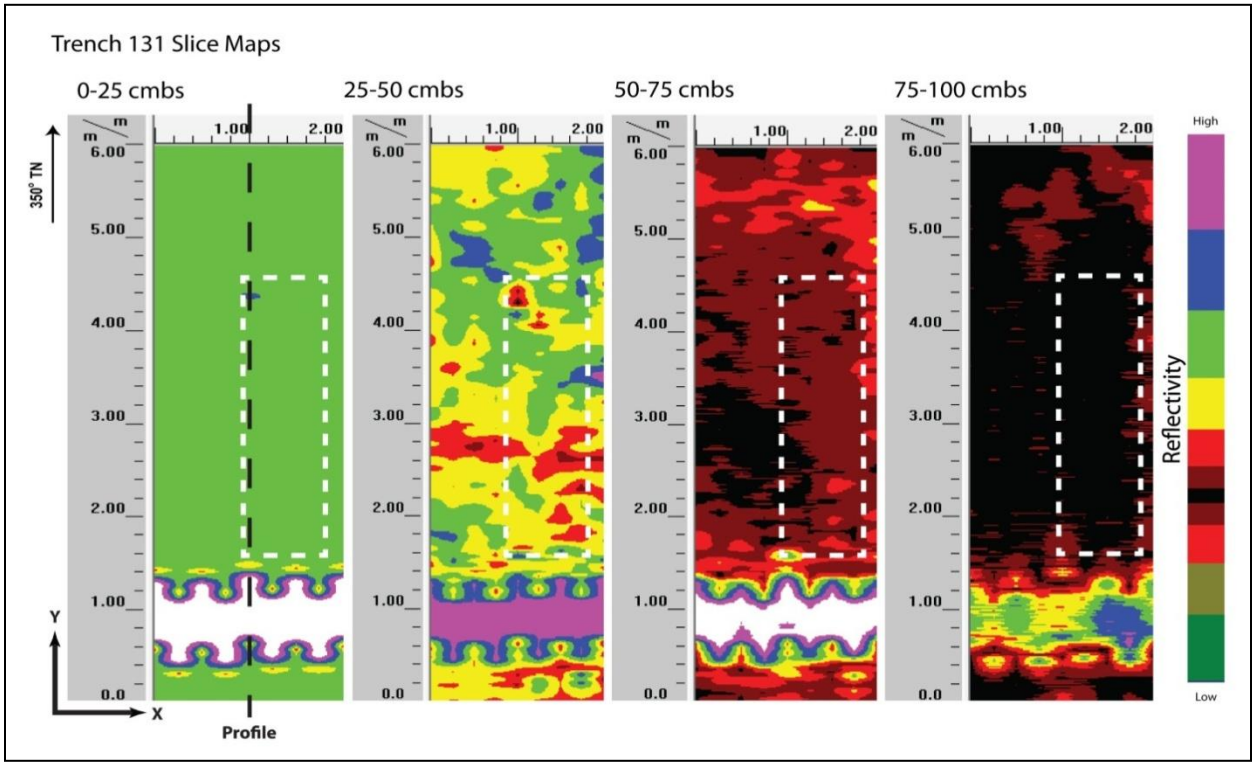

Figure 43. Slice maps of T-131 at 25cm depth intervals

A visual comparison of the excavated profile and the GPR signal profile showed a moderate correlation in stratigraphic transitions (Figure 44). Strata Ia and Id were clearly observed and occured at the ground-truthed depths. A concrete jacket was found 0.8 mbs. The concrete jacket did not showed up on the profile or slice maps. No other discrete objects were observed in the GPR results or subsequent excavation.

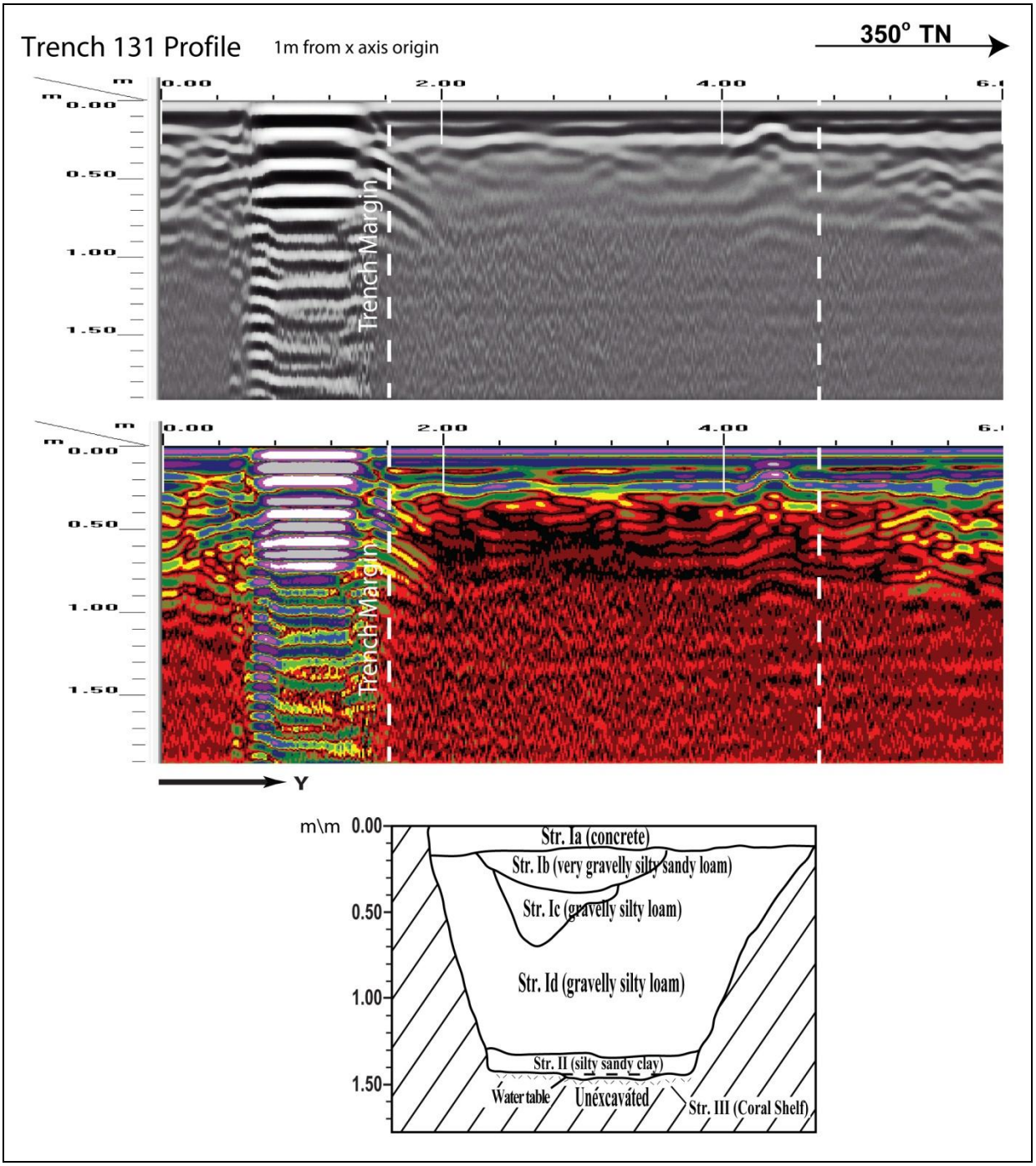

Figure 44. Visual comparison of excavated profile and GPR signal profile of T-131

Test Excavation 132

T-132 measured 0.6 m by 6.0 m and was oriented northwest to southeast, and was located within a parking lot southwest of Halekauwila Street, 60.0 m southeast of Halekauwila Street and South Street intersection. The GPR grid measured 3.0 m by 9.0 m with 0.25 m spacing between Y transects and 1.0 m spacing between X transects. Utilities located near the excavation include: sewer line 5.5 m southeast. No utilities transected the excavation location.

A review of amplitude slice maps indicated a linear feature but not within excavation boundaries. Reflectivity was relatively uniform throughout the grid and decreased with depth except for the linear feature. A transition from higher reflectivity to lower reflectivity was observed at approximately 0.75 mbs (Figure 45).

GPR depth profiles for T-132 identified horizontal banding, commonly associated with stratigraphic layering, throughout the survey area (Figure 46). This banding corresponded to variations of density and chemical composition within fill deposits. The profile also indicated a change in reflectivity that occurred around 0.1 mbs and again around 0.4 mbs. An anomaly was observed in the profile but not within excavation boundaries. The maximum depth of clean signal return was approximately 1.15 mbs.

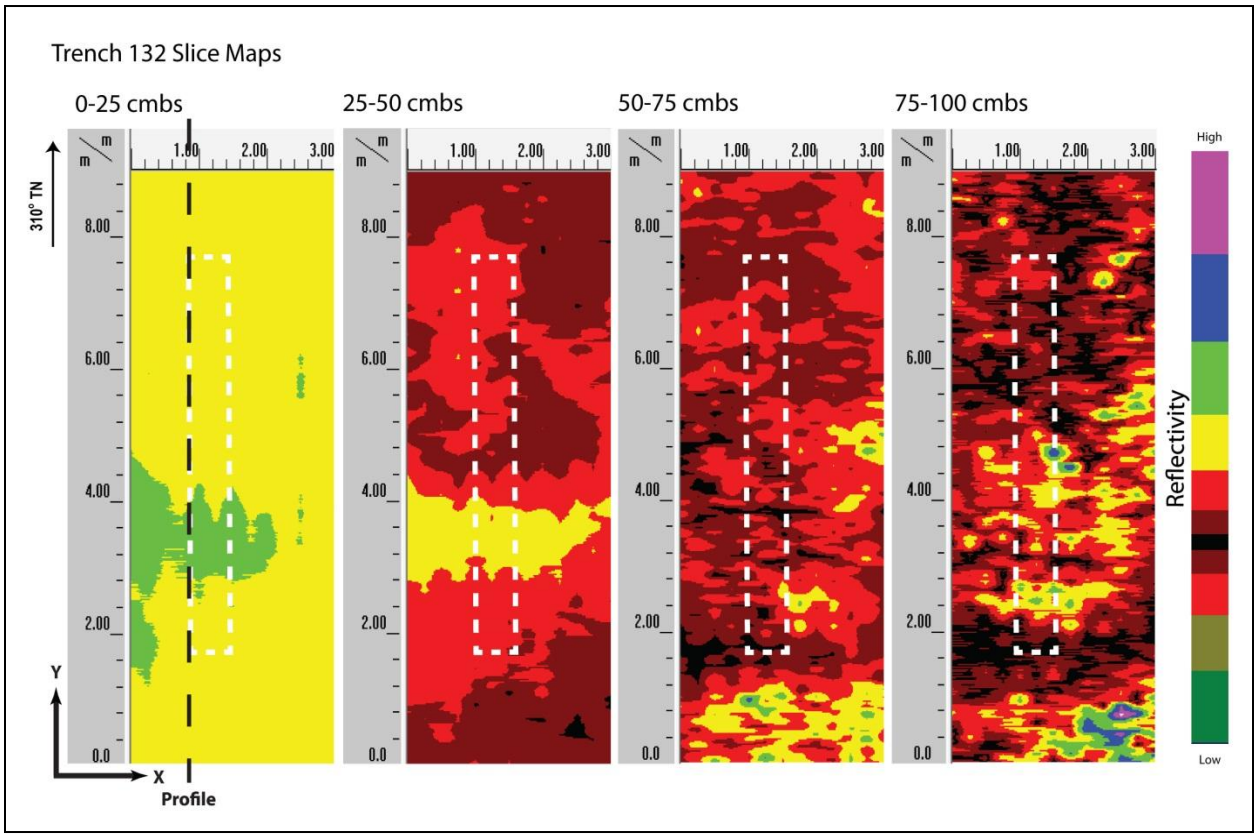

Figure 45. Slice maps of T-132 at 25cm depth intervals

A visual comparison of the excavated profile and the GPR signal profile showed a strong correlation in stratigraphic transitions (Figure 46). Strata Ia to Ie were clearly observed and occured at the ground-truthed depths. Textural changes in the form of multiple small hyperbolas were apparent in Stratum Ic which was gravelly clay fill. All other sediment transitions were below the maximum clean signal return depth. No discrete objects were observed in the GPR results or subsequent excavation.

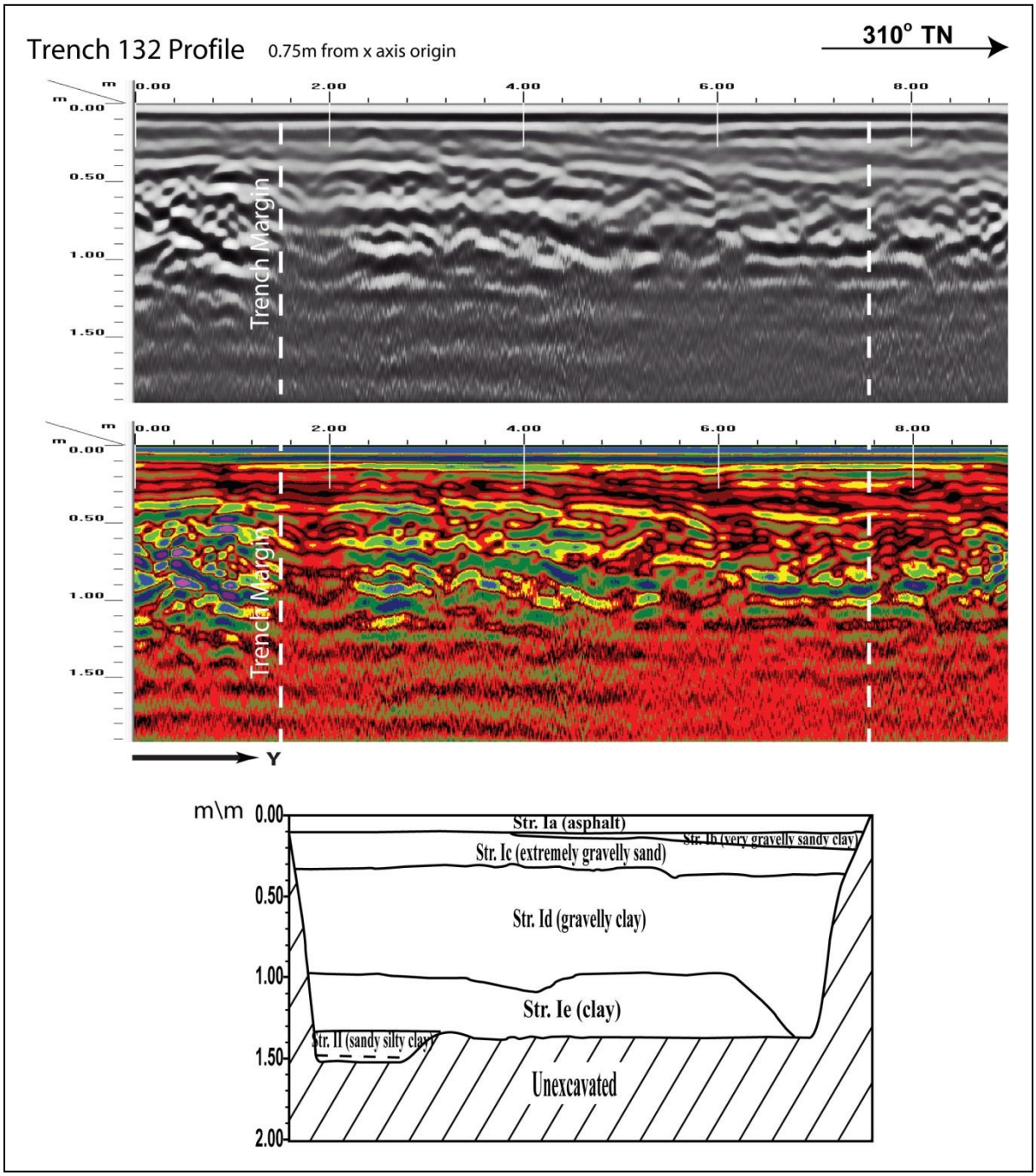

Figure 46. Visual comparison of excavated profile and GPR signal profile of T-132

Test Excavation 133

T-133 measured 0.6 m by 6.0 m and was oriented northeast to southwest and was located within in a parking lot southwest of Halekauwila Street, 65.0 m northwest of Halekauwila Street and Keawe Street intersection,. The GPR grid measured 1.5 m by 8.0 m with 0.25 m spacing between Y transects and 1.0 m spacing between X transects. Utilities located near the excavation include: sewer line 5.0 m northwest. No utilities transected the GPR grid or excavation location.

A review of amplitude slice maps indicated no linear features which might indicate the presence of utilities. Reflectivity was relatively uniform throughout the grid and decreased with depth. A transition from higher reflectivity to lower reflectivity was observed at approximately 0.25 mbs (Figure 47).

GPR depth profiles for T-133 identified horizontal banding, commonly associated with stratigraphic layering, throughout the survey area (Figure 48). This banding corresponded to variations of density and chemical composition within fill deposits. The profile also indicated a change in reflectivity that occurred around 0.3 mbs. An anomaly was observed in the profile but not within excavation boundaries. The maximum depth of clean signal return was approximately 1.10 mbs.

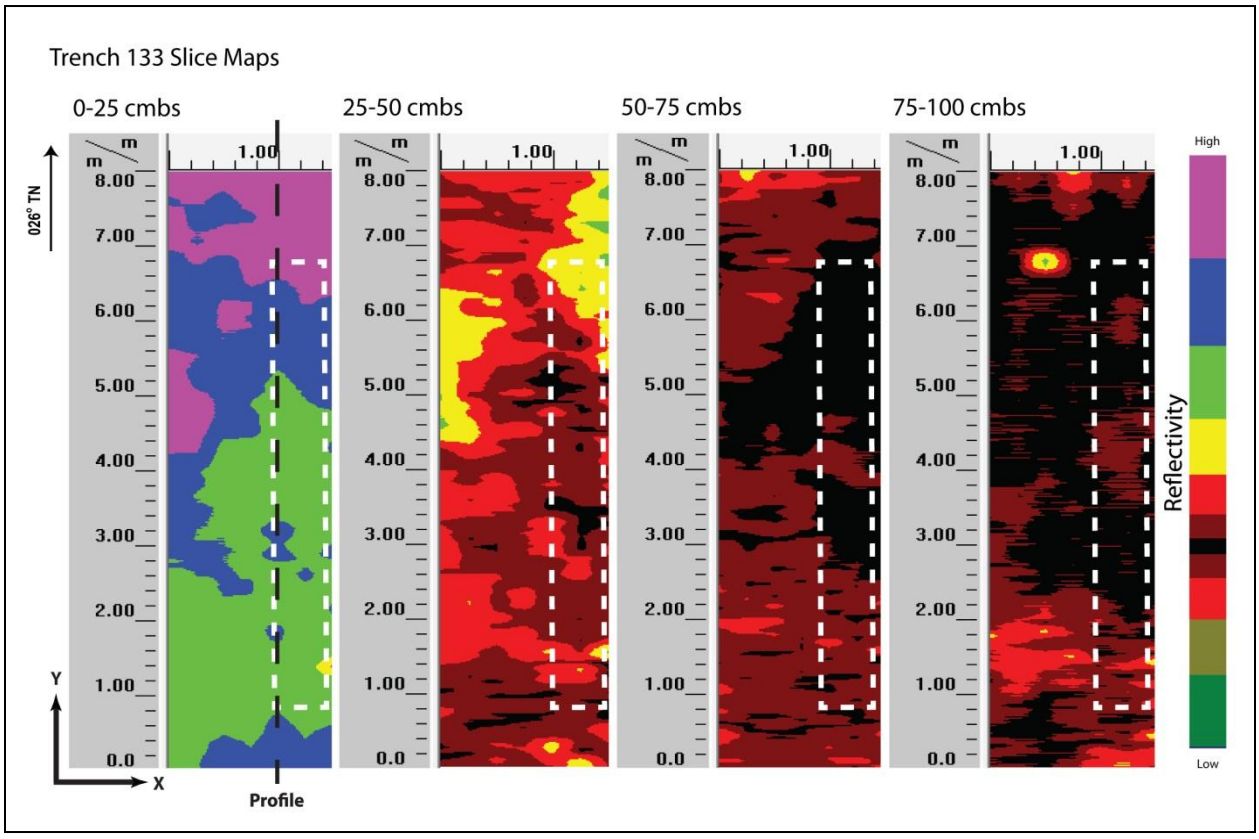

Figure 47. Slice maps of T-133 at 25cm depth intervals

A visual comparison of the excavated profile and the GPR signal profile showed a moderate correlation in stratigraphic transitions (Figure 48). Strata Ia to Ic were clearly observed and occured at the ground-truthed depths. Strata included: asphalt, very gravelly silty sand fill, sandy clay loam fill, sandy loam fill, gravelly sandy loam fill, sandy clay fill, sandy clay fill, and natural silty sand. No discrete objects or other stratigraphic transitions were observed in the GPR results or subsequent excavation.

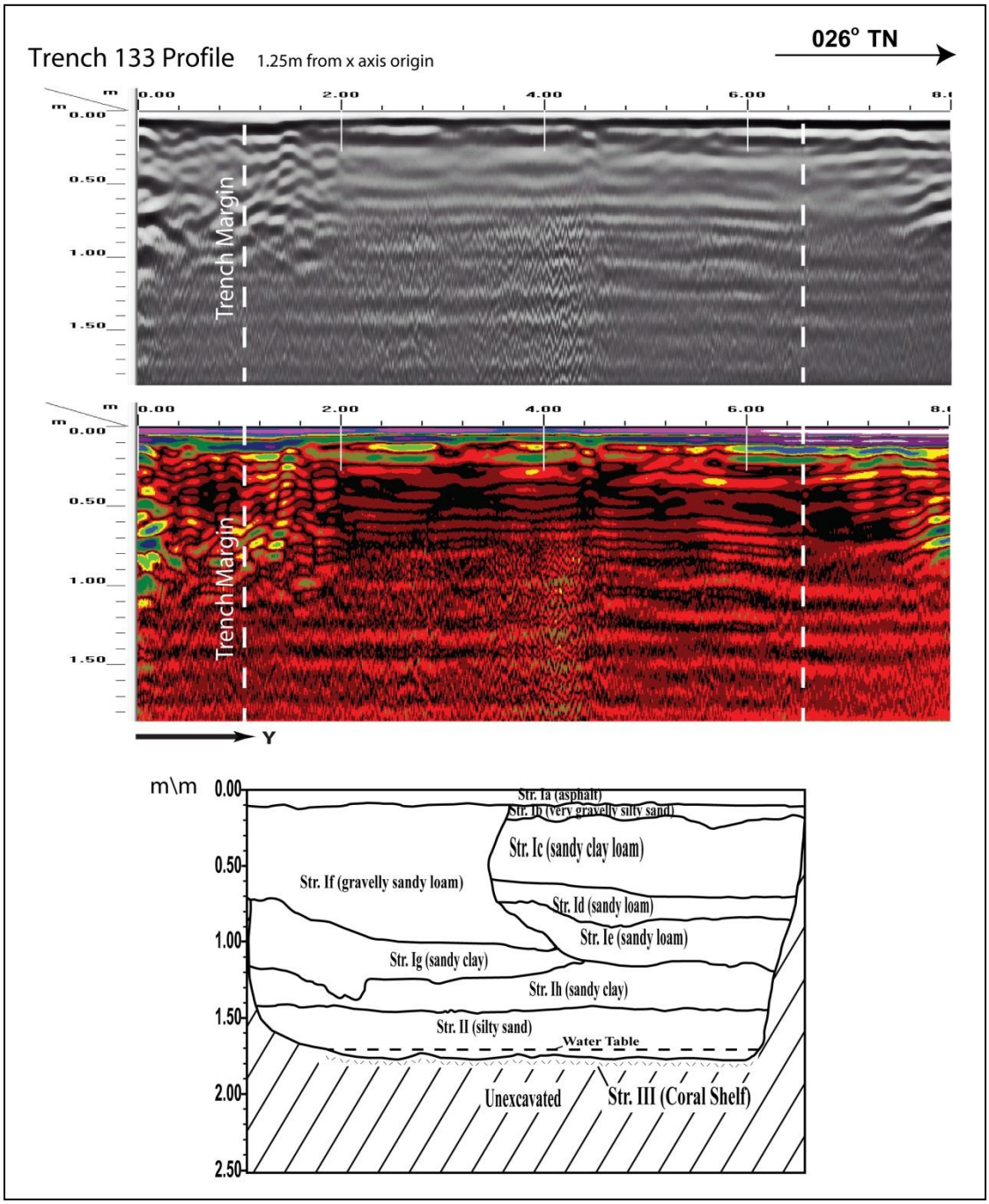

Figure 48. Visual comparison of excavated profile and GPR signal profile of T-133

Test Excavation 134

T-134 measured 0.9 m by 3.0 m and was oriented northwest to southeast, and was located within the sidewalk northeast of Halekauwila Street, 55.0 m northwest of Halekauwila Street and Keawe Street intersection. The GPR grid measured 2.0 m by 6.0 m with 0.25 m spacing between Y transects and 1.0 m spacing between X transects. Utilities located near the excavation include: electrical line 0.4 m southwest, telephone line 2.3 m southwest, sewer line 3.9 m southwest.

A review of amplitude slice maps indicated no linear features which might indicate the presence of utilities. Reflectivity was relatively uniform throughout the grid and decreased with depth. A transition from higher reflectivity to lower reflectivity was observed at approximately 0.25 mbs (Figure 49).

GPR depth profiles for T-134 identified horizontal banding, commonly associated with stratigraphic layering, throughout the survey area (Figure 50). This banding corresponded to variations of density and chemical composition within fill deposits. The profile also indicated a change in reflectivity that occurred around 0.15 mbs. No utilities were observed in the profile. The maximum depth of clean signal return was approximately 1.0 mbs.

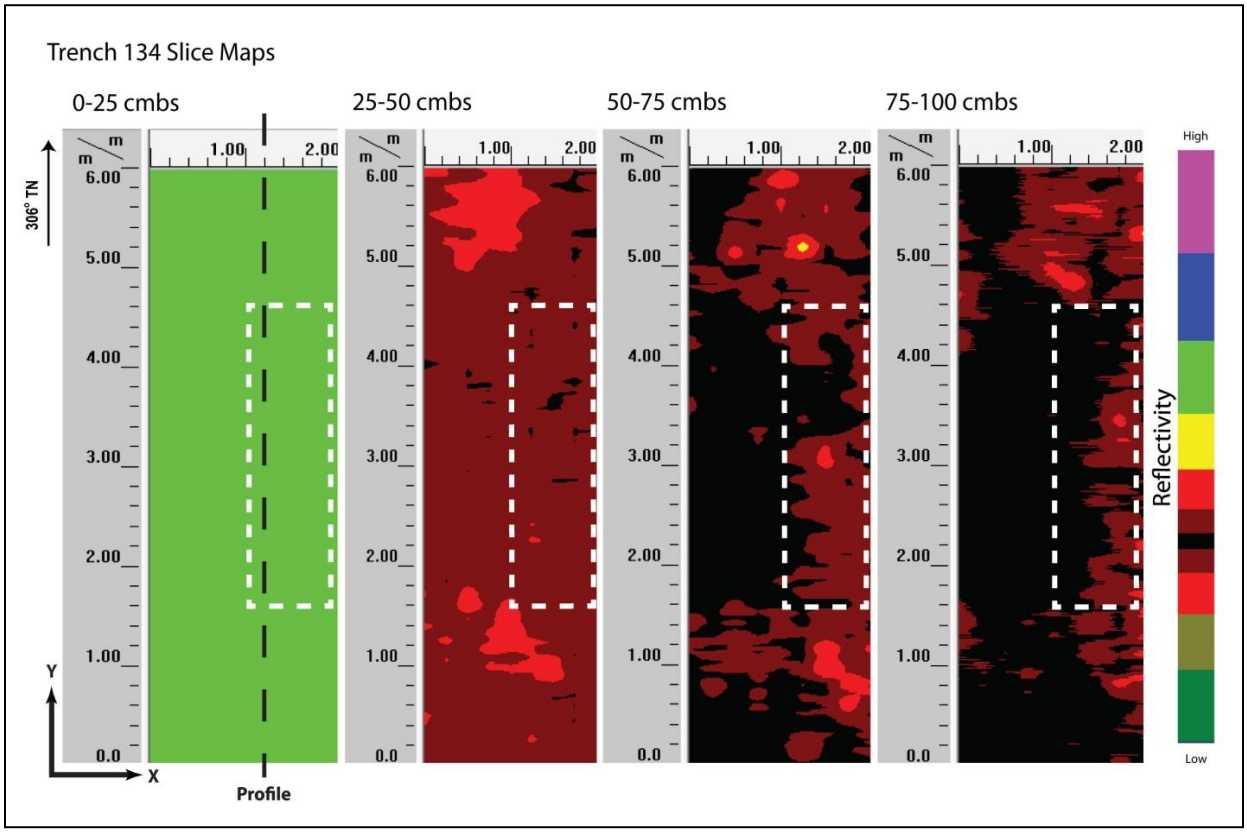

Figure 49. Slice maps of T-134 at 25cm depth intervals

A visual comparison of the excavated profile and the GPR signal profile showed a moderate correlation in stratigraphic transitions (Figure 50). Strata Ia to Id were all clearly observed and occured near the ground-truthed depths. A large piece of concrete was found 0.25 mbs. This concrete did not showed up on the profile or slice maps. This may be due to the fact that the concrete was not reinforced with steel (rebar) or that the concrete has a similar density to the surrounding stratum. No discrete objects or other stratigraphic transitions were observed in the GPR results or subsequent excavation.

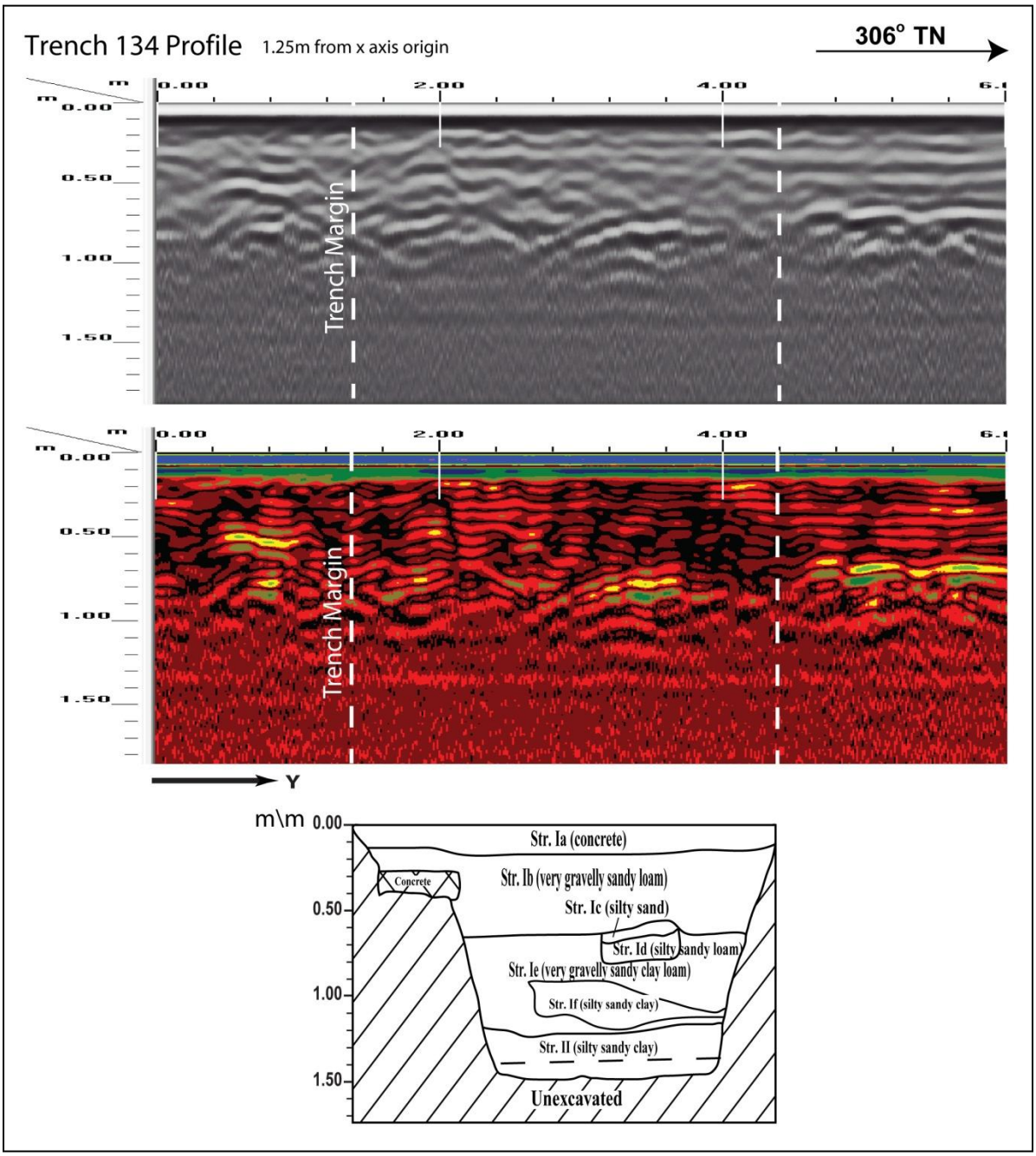

Figure 50. Visual comparison of excavated profile and GPR signal profile of T-134

Test Excavation 136

T-136 measured 0.6 m by 6.0 m and was oriented northwest to southeast and was located within the sidewalk northeast of Halekauwila Street, 45.0 m northwest of Halekauwila Street and Keawe Street intersection. The GPR grid measured 2.0 m by 9.0 m with 0.25 m spacing between Y transects and 1.0 m spacing between X transects. Utilities located near the excavation include: electrical line 0.6 m southwest, sewer line 4.0 m southwest. A concrete jacket was encountered 1.10 mbs in the northwest end of the excavation.

A review of amplitude slice maps indicated no linear features which might indicate the presence of utilities. Reflectivity was relatively uniform throughout the grid and decreased with depth. A transition from higher reflectivity to lower reflectivity was observed at approximately 0.5 mbs (Figure 51).

GPR depth profiles for T-136 identified horizontal banding, commonly associated with stratigraphic layering, throughout the survey area (Figure 52). This banding corresponded to variations of density and chemical composition within fill deposits. The profile also indicated a change in reflectivity that occurred around 0.25 mbs. An anomaly was observed in the profile but was not encountered during excavation. The maximum depth of clean signal return was approximately 0.8 mbs.

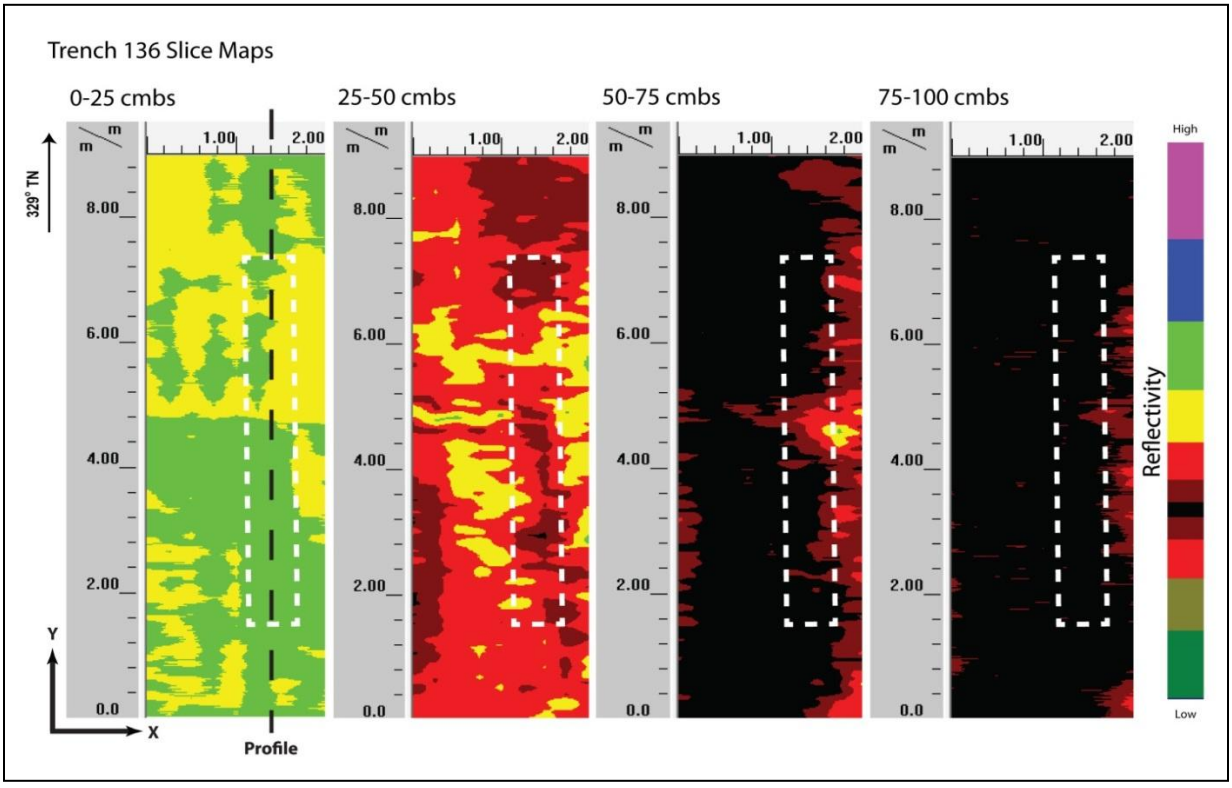

Figure 51. Slice maps of T-136 at 25cm depth intervals

A visual comparison of the excavated profile and the GPR signal profile showed a moderate correlation in stratigraphic transitions (Figure 52). Strata Ia to Ib were clearly observed and occured near the ground-truthed depths. A concrete jacket was found 1.10 mbs. This jacket did not showed up on the profile or slice maps due to the fact that it was below the maximum clean signal return depth. No other discrete objects were observed in the GPR results or subsequent excavation.

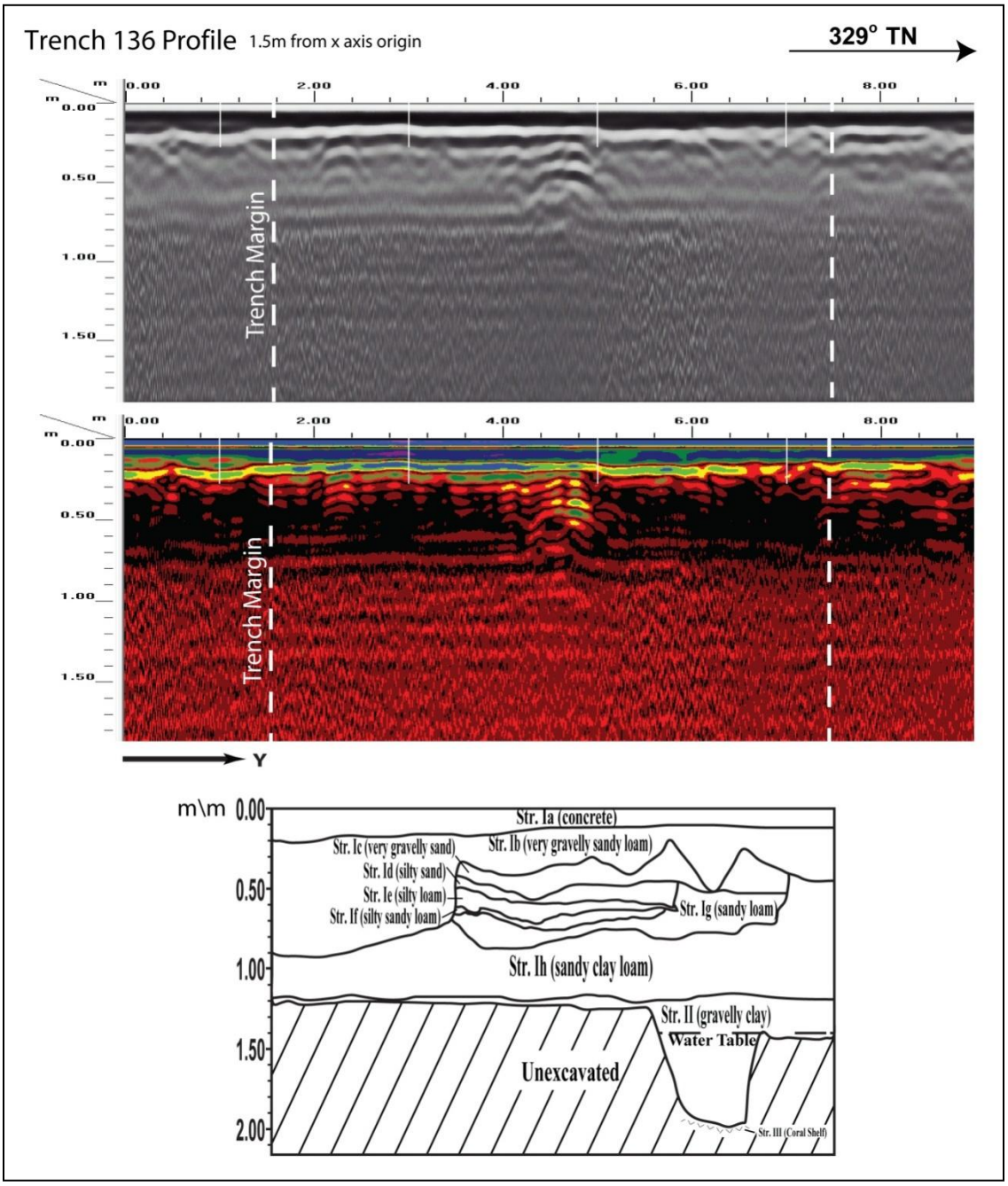

Figure 52. Visual comparison of excavated profile and GPR signal profile of T-136

Test Excavation 137

T-137 measured 0.6 m by 6.0 m and was oriented northwest to southeast and was located on the sidewalk northeast of Halekauwila Street and 25.0 measured 0.6 m by 6.0 measured 0.6 m by 6.0 m northwest of Halekauwila Street and Keawe Street intersection. The GPR grid measured 2.0 m by 6.0 m with 0.25 m spacing between Y transects and 1.0 m spacing between X transects. Utilities located near the excavation include: electrical line 0.6 m southwest, water line 1.7 m northwest. No utilities transected the GPR grid or excavation location.

A review of amplitude slice maps indicated no linear features which might indicate the presence of utilities. Reflectivity was relatively uniform throughout the grid and decreased with depth. A transition from higher reflectivity to lower reflectivity was observed at approximately 0.5 mbs (Figure 53).

GPR depth profiles for T-137 identified horizontal banding, commonly associated with stratigraphic layering, throughout the survey area (Figure 54). This banding corresponded to variations of density and chemical composition within fill deposits. The profile also indicated a change in reflectivity that occurred around 0.3 mbs. An anomaly was observed in the profile but was not encountered during excavation. The maximum depth of clean signal return was approximately 0.8 mbs.

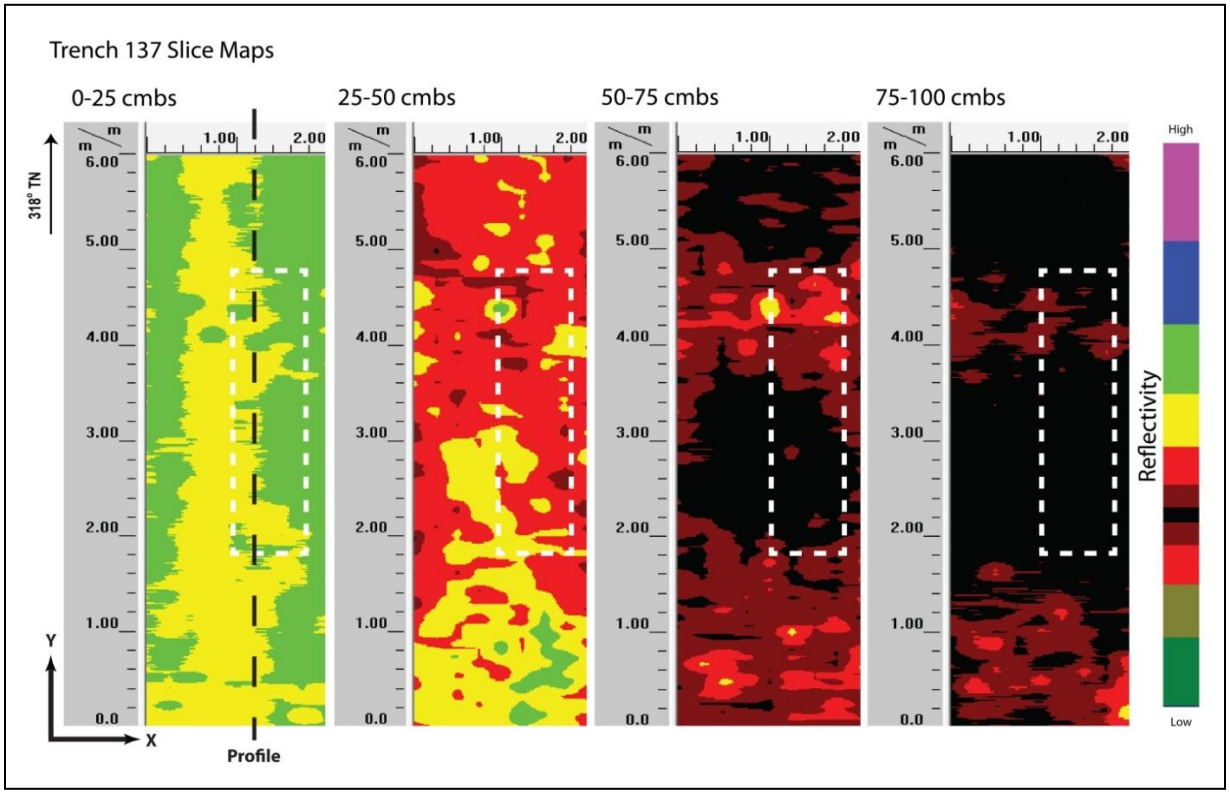

Figure 53. Slice maps of T-137 at 25cm depth intervals

A visual comparison of the excavated profile and the GPR signal profile showed a strong correlation in stratigraphic transitions (Figure 54). Strata Ia and Ib were clearly observed and occured near the ground-truthed depths. Textural changes in the form of multiple small hyperbolas were apparent in Stratum Ib which was very gravelly loamy sand fill. All other sediment transitions were below the maximum clean signal return depth. No discrete objects were observed in the GPR results or subsequent excavation.

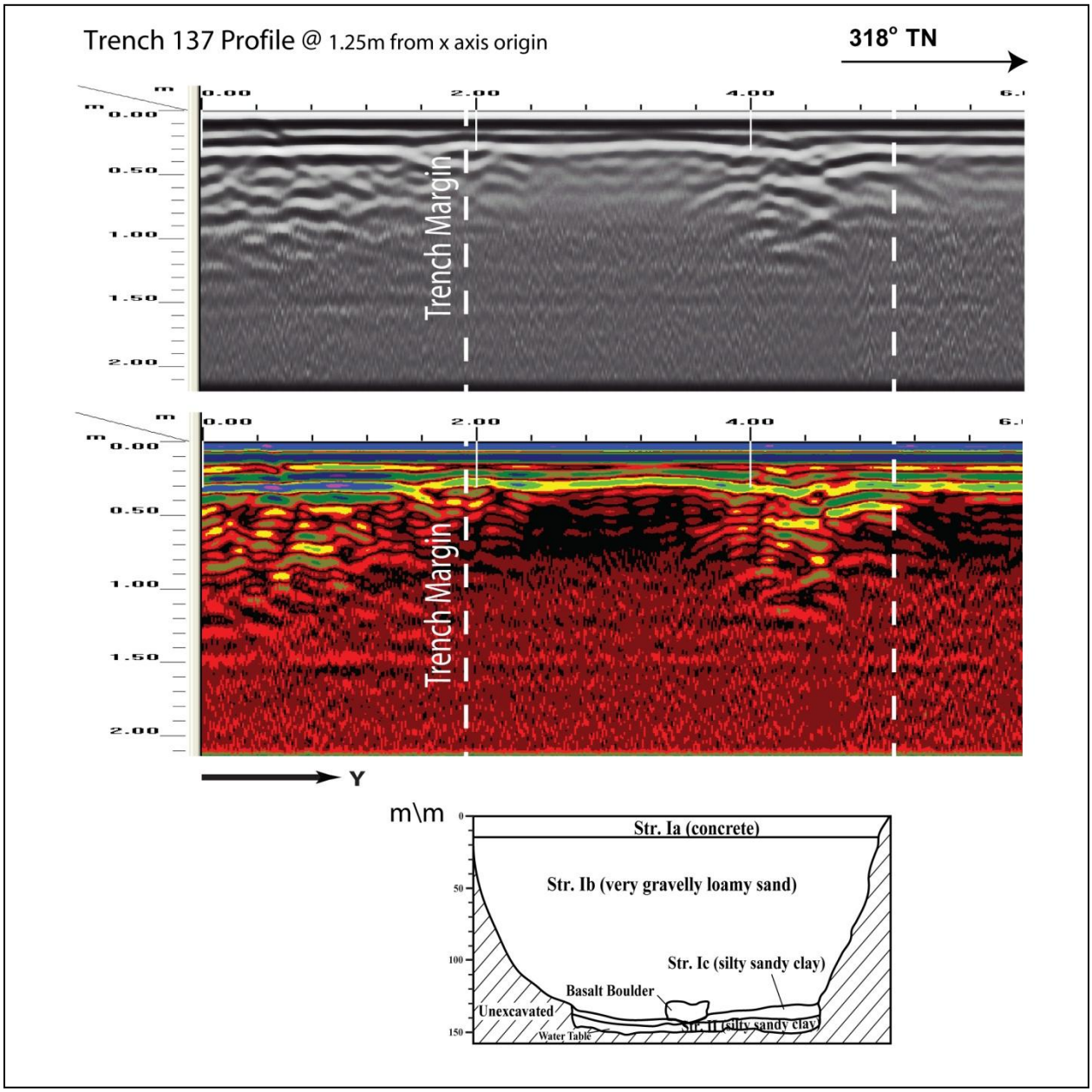

Figure 54. Visual comparison of excavated profile and GPR signal profile of T-137

Test Excavation 138

T-138 measured 0.6 m by 6.0 m and was oriented northwest to southeast and was located within a parking lot southwest of Halekauwila Street, 25.0 m northwest of Halekauwila Street and Keawe Street intersection. The GPR grid measured 3.0 m by 9.0 m with 0.25 m spacing between Y transects and 1.0 m spacing between X transects. Utilities located near the excavation include: sewer line 9.9 m northeast. No utilities transected the GPR grid or excavation location.

A review of amplitude slice maps indicated no linear features which might indicate the presence of utilities. Reflectivity was relatively uniform throughout the grid and decreased with depth. A transition from higher reflectivity to lower reflectivity was observed at approximately 0.25 mbs (Figure 55).

GPR depth profiles for T-138 identified horizontal banding, commonly associated with stratigraphic layering, throughout the survey area (Figure 56). This banding corresponded to variations of density and chemical composition within fill deposits. The profile also indicated a change in reflectivity that occurred around 0.1 mbs. No utilities were observed in the profile. The maximum depth of clean signal return was approximately 1.0 mbs.

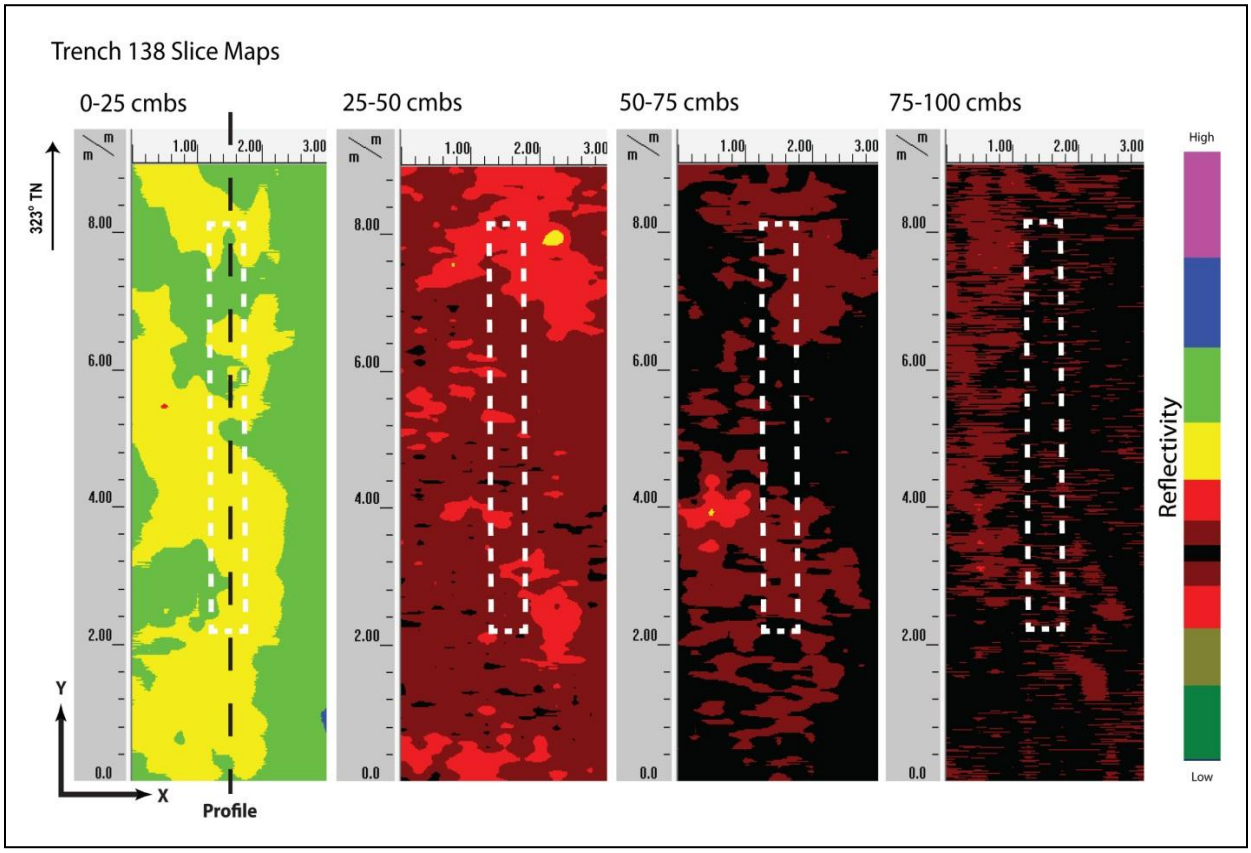

Figure 55. Slice maps of T-138 at 25cm depth intervals

A visual comparison of the excavated profile and the GPR signal profile showed a moderate correlation in stratigraphic transitions (Figure 56). Strata Ia, Ib and Id were all clearly observed and occured near the ground-truthed depths. Strata include: asphalt, very gravelly sandy loam fill, loam fill, very gravelly sand fill, very gravelly silty sandy loam fill, sandy silty loam fill, gravelly sandy silty loam fill, very gravelly silty loamy sand fill, burnt trash layer, and natural silty clay. No discrete objects or other stratigraphic transitions were observed in the GPR results or subsequent excavation.

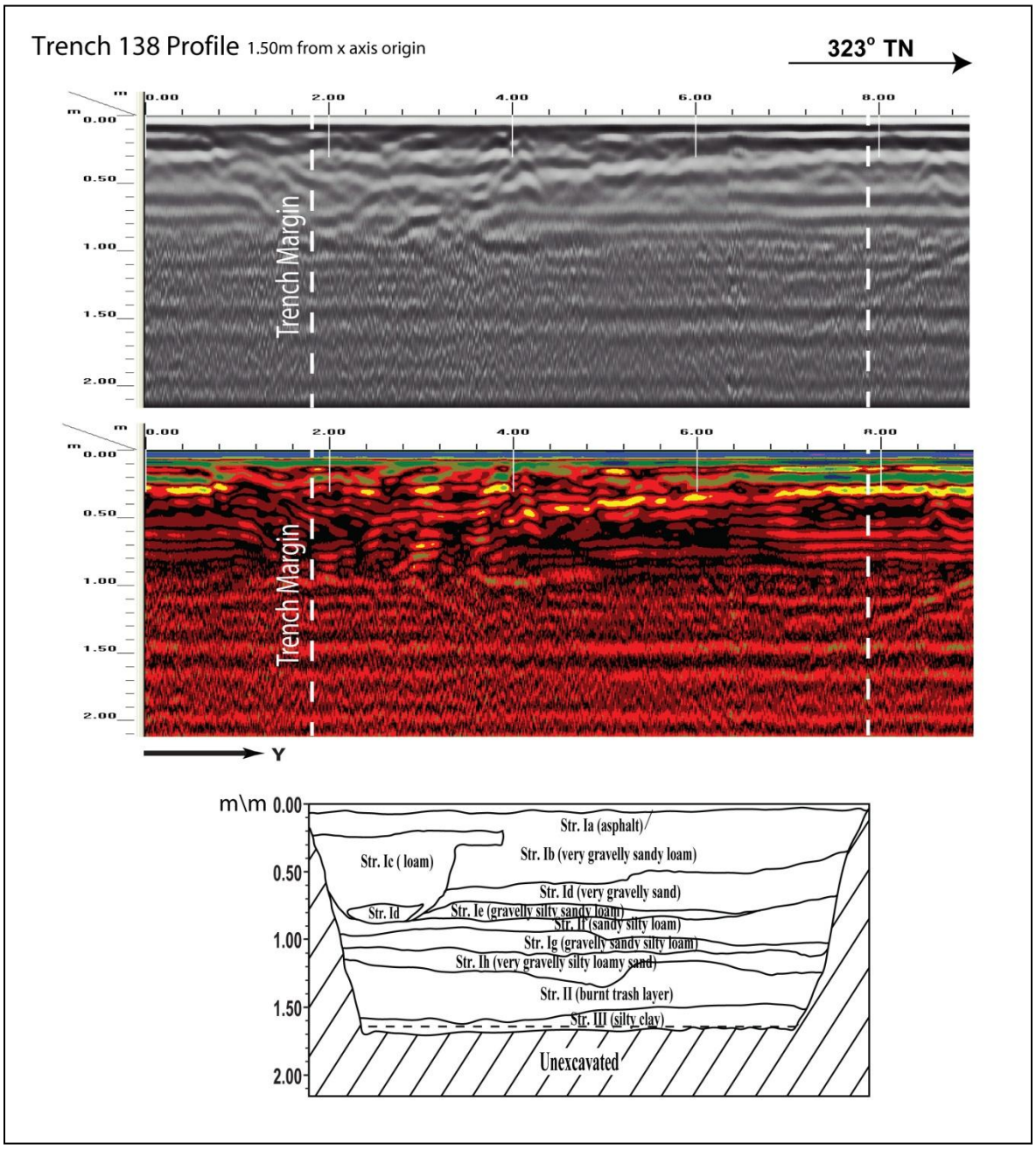

Figure 56. Visual comparison of excavated profile and GPR signal profile of T-138

Test Excavation 139

T-139 measured 0.6 m by 6.0 m and was oriented northwest to southeast, and was located within a parking lot on Halekauwila Street, 20.0 m west of Halekauwila Street and Keawe Street intersection. The GPR grid measured 3.0 m by 9.0 m with 0.25 m spacing between the Y transects and 1.0 m spacing between the X transects. Utilities located near the excavation include: electrical line 3.1 m southeast. No utilities transected the GPR grid or excavation location.

A review of amplitude slice maps indicated no linear features which might indicate the presence of utilities. Reflectivity was relatively uniform throughout the grid and decreased with depth. A transition from higher reflectivity to lower reflectivity was observed at approximately 0.25 mbs (Figure 57).

GPR depth profiles for T-139 identified horizontal banding, commonly associated with stratigraphic layering, throughout the survey area (Figure 58). This banding corresponded to variations of density and chemical composition within fill deposits. The profile also indicated a change in reflectivity that occurred around 0.25 mbs. No utilities were observed in the profile. The maximum depth of clean signal return was approximately 1.0 mbs.

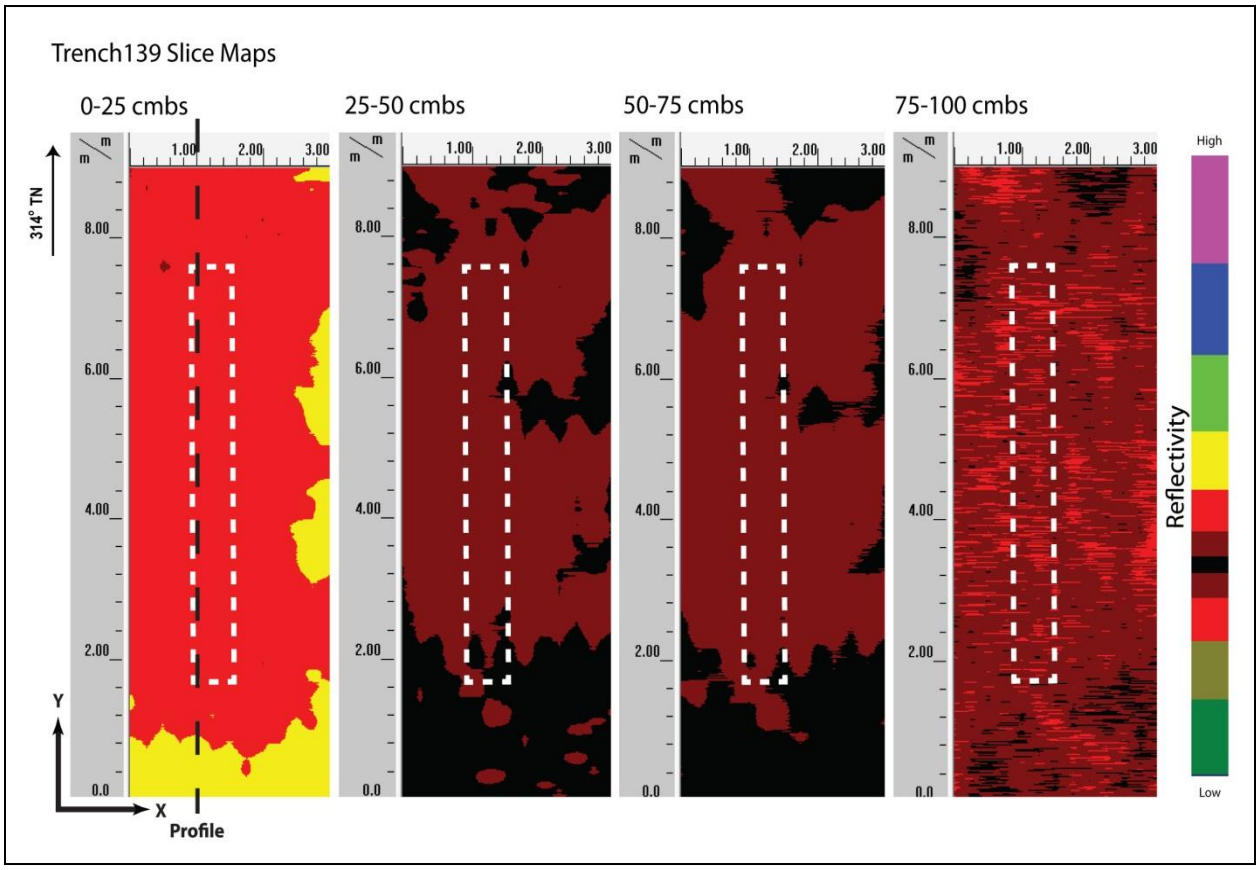

Figure 57. Slice maps of T-139 at 25cm depth intervals

A visual comparison of the excavated profile and the GPR signal profile showed a weak correlation in stratigraphic transitions (Figure 58). Strata included: asphalt, gravelly sandy clay loam fill, gravelly silty clay fill, very gravelly sandy silty clay fill, and extremely gravelly sand. These transitions were not clearly depicted in the GPR profile at the depths that they occured. No other sediment transitions or discrete objects were observed in the GPR results or subsequent excavation.

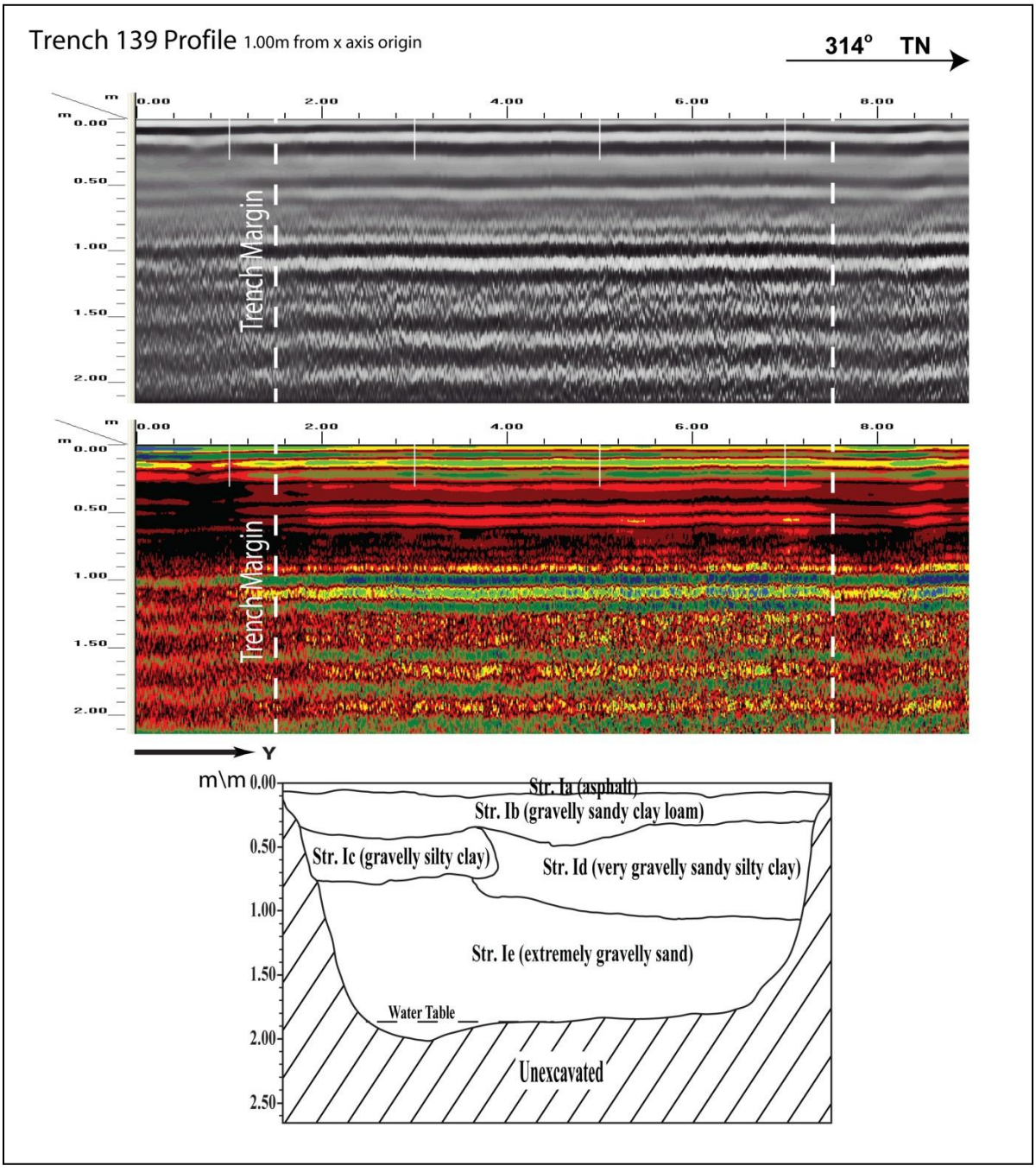

Figure 58. Visual comparison of excavated profile and GPR signal profile of T-139

Test Excavation 140

T-140 measured 0.6 m by 6.0 m and was oriented northwest to southeast and was located within the road cut of Halekauwila Street, 7.0 m southeast of Halekauwila Street and Keawe Street intersection. The GPR grid measured 3.0 m by 6.0 m with 0.25 m spacing between Y transects and 1.0 m spacing between X transects. Utilities located near the excavation include: electrical line 1.6 m southwest. A concrete jacket was encountered 0.43 mbs in the southeastern end and a cast iron pipe was encountered 0.97 mbs in the northwestern end of the excavation.

A review of amplitude slice maps indicated no linear features although a concrete jacket and a pipe were encountered during excavation. Reflectivity was relatively uniform throughout the grid and decreased with depth. A transition from higher reflectivity to lower reflectivity was observed at approximately 0.25 mbs (Figure 59).

GPR depth profiles for T-140 identified horizontal banding, commonly associated with stratigraphic layering, throughout the survey area (Figure 60). This banding corresponded to variations of density and chemical composition within fill deposits. The profile also indicated a change in reflectivity that occurred around 0.25 mbs. No utilities were observed in the profile although a concrete jacket and pipe were encountered during excavation. The maximum depth of clean signal return was approximately 1.0 mbs.

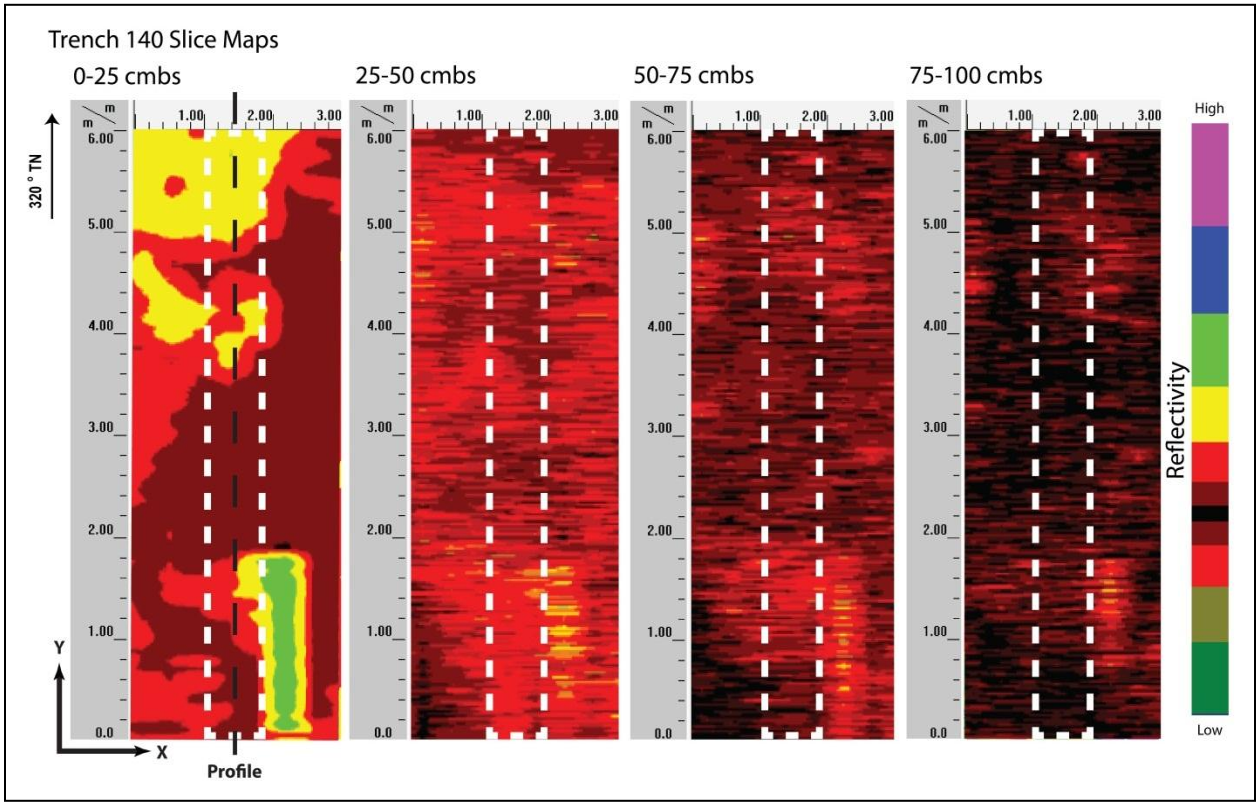

Figure 59.Slice maps of T-140 at 25cm depth intervals

A visual comparison of the excavated profile and the GPR signal profile showed a weak correlation in stratigraphic transitions (Figure 60). Strata included: asphalt, gravel, gravel, gravel, gravelly sandy silty loam fill, cobbly sand fill, sandy clay loam fill, silty clay fill and natural clay. These transitions were not clearly depicted in the GPR profile at the depths that they occured. A concrete jacket and cast iron pipe were found 0.43 and 0.97 mbs, respectively. The jacket and pipe did not show up in the profile or slice maps. This may be due to the fact that the concrete was not reinforced with steel (rebar) or that it had a similar density to the surrounding stratum. The pipe was near the maximum clean signal return depth which may be why it was not picked up by the GPR. No other sediment transitions or discrete objects were observed in the GPR results or subsequent excavation.

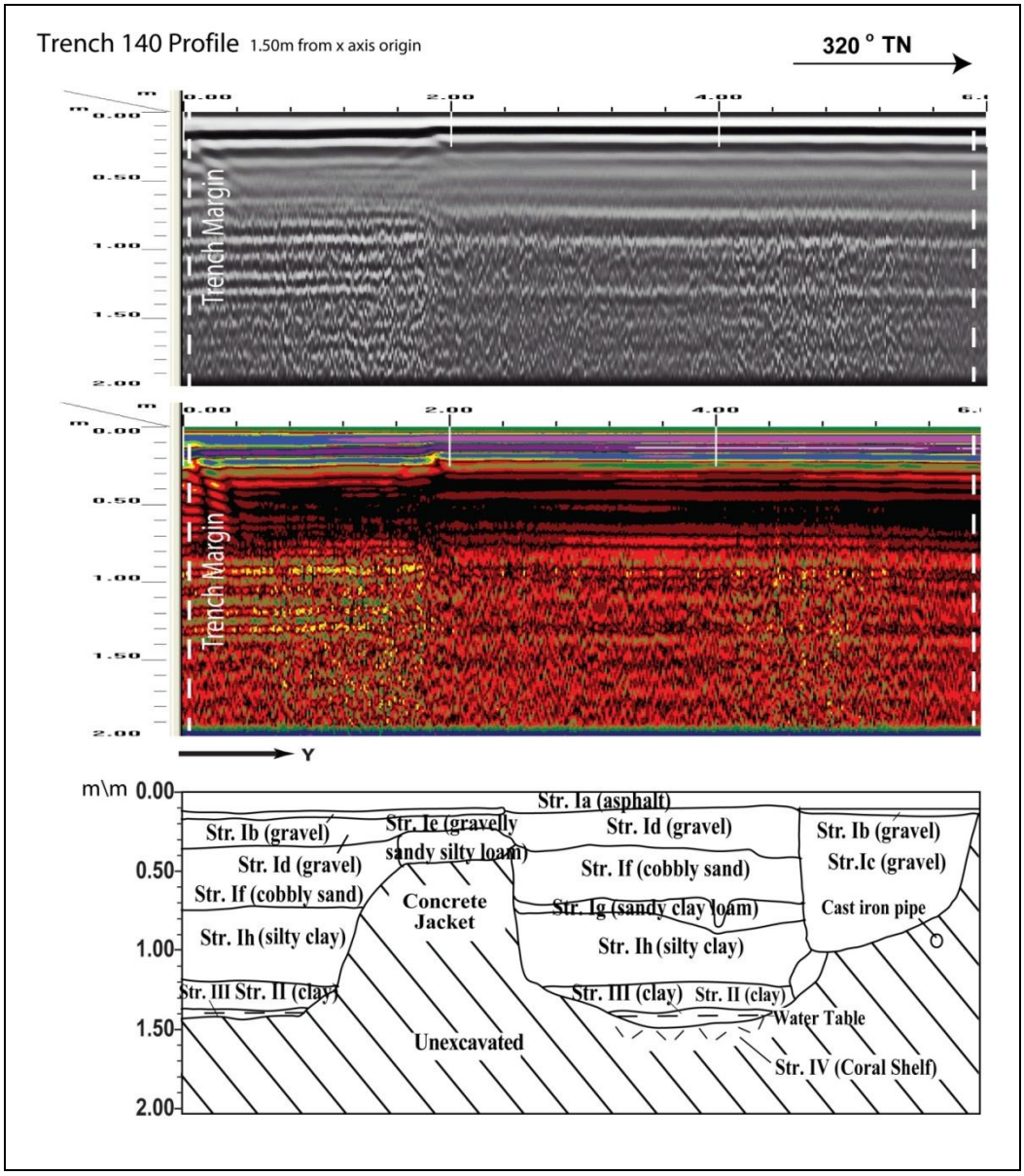

Figure 60. Visual comparison of excavated profile and GPR signal profile of T-140

Test Excavation 141

T-141 measured 0.9 m by 3.0 m and was oriented northwest to southeast and was located within a parking lot southeast of Halekauwila Street, 10.0 m east of Halekauwila Street and Keawe Street intersection. The GPR grid measured 3.0 m by 6.0 m with 0.25 m spacing between Y transects and 1.0 m spacing between X transects. Utilities located near the excavation include: electrical line 3.3 m southwest, storm drain 3.6 m northwest. No utilities transected the excavation location although several isolated human skeletal remains were encountered approximately 0.7 mbs.

A review of amplitude slice maps indicated a linear feature but not within excavation boundaries. Reflectivity was relatively uniform throughout the grid and decreased with depth. A transition from higher reflectivity to lower reflectivity was observed at approximately 0.75 mbs (Figure 61).

GPR depth profiles for T-141 identified horizontal banding, commonly associated with stratigraphic layering, throughout the survey area (Figure 62). This banding corresponded to variations of density and chemical composition within fill deposits. The profile also indicated a change in reflectivity that occurred around 0.2 mbs. An anomaly was observed in the profile but not within excavation boundaries. The maximum depth of clean signal return was approximately 1.0 mbs.

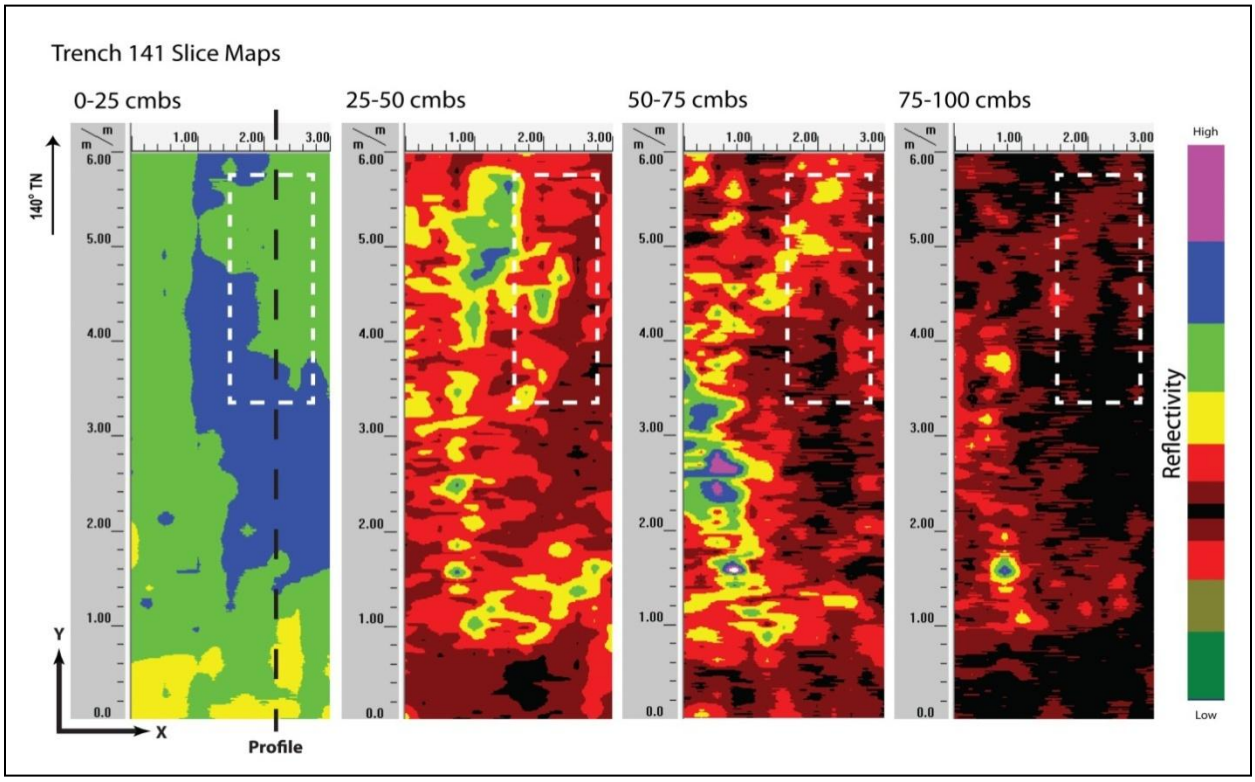

Figure 61. Slice maps of T-141 at 25cm depth intervals

A visual comparison of the excavated profile and the GPR signal profile showed a weak correlation in stratigraphic transitions (Figure 62). Strata included: asphalt, very gravelly silt loam, sandy loam fill, extremely gravelly sand, natural loamy sand, natural sand,and natural silty sand. These transitions were not clearly depicted in the GPR profile at the depths that they occured. No other sediment transitions or discrete objects were observed in the GPR results or subsequent excavation.

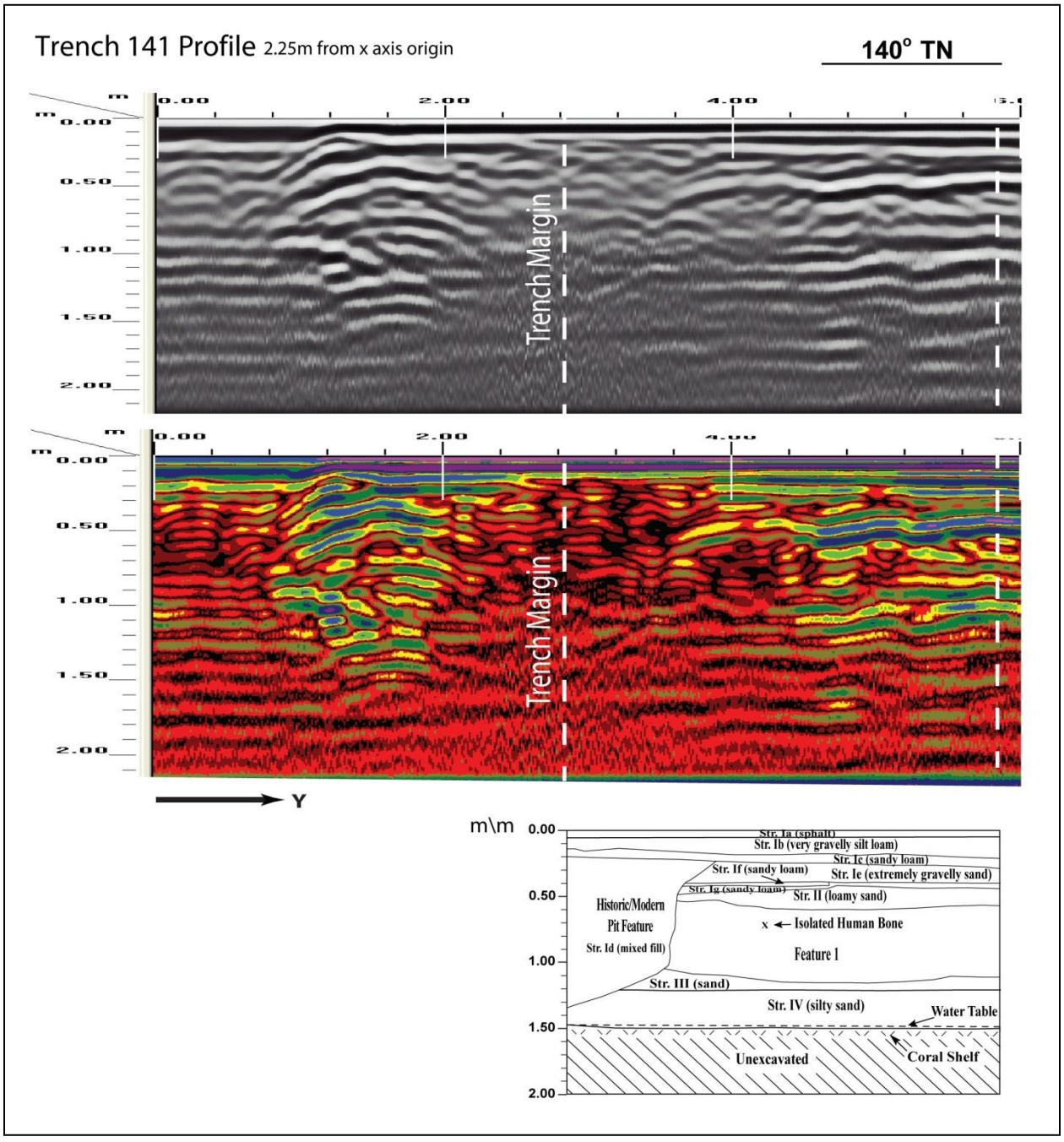

Figure 62. Visual comparison of excavated profile and GPR signal profile of T-141

Test Excavation 142

T-142 measured 0.6 m by 6.0 m and was oriented northwest to southeast and was located within a parking lot southeast of Halekauwila Street, 35.0 m southeast of Halekauwila Street and Keawe Street intersection. The GPR grid measured 2.5 m by 6.0 m with 0.25 m spacing between Y transects, and 1.0 m spacing between X transects. Utilities located near the excavation include: telephone line 1.5 m southwest, sewer line 4.0 m southwest. No utilities transected the GPR grid or excavation location although an intact human burial was encountered 1.0 to 1.12 mbs in the southeast end of the excavation.

A review of amplitude slice maps indicated no linear features which might indicate the presence of utilities. Reflectivity was relatively uniform throughout the grid and decreased with depth. A transition from higher reflectivity to lower reflectivity was observed at approximately 0.75 mbs (Figure 63).

GPR depth profiles for T-142 identified horizontal banding, commonly associated with stratigraphic layering, throughout the survey area (Figure 64). This banding corresponded to variations of density and chemical composition within fill deposits. The profile also indicated a change in reflectivity that occurred around 0.2 mbs. No utilities were observed in the profile. The maximum depth of clean signal return was approximately 1.3 mbs.

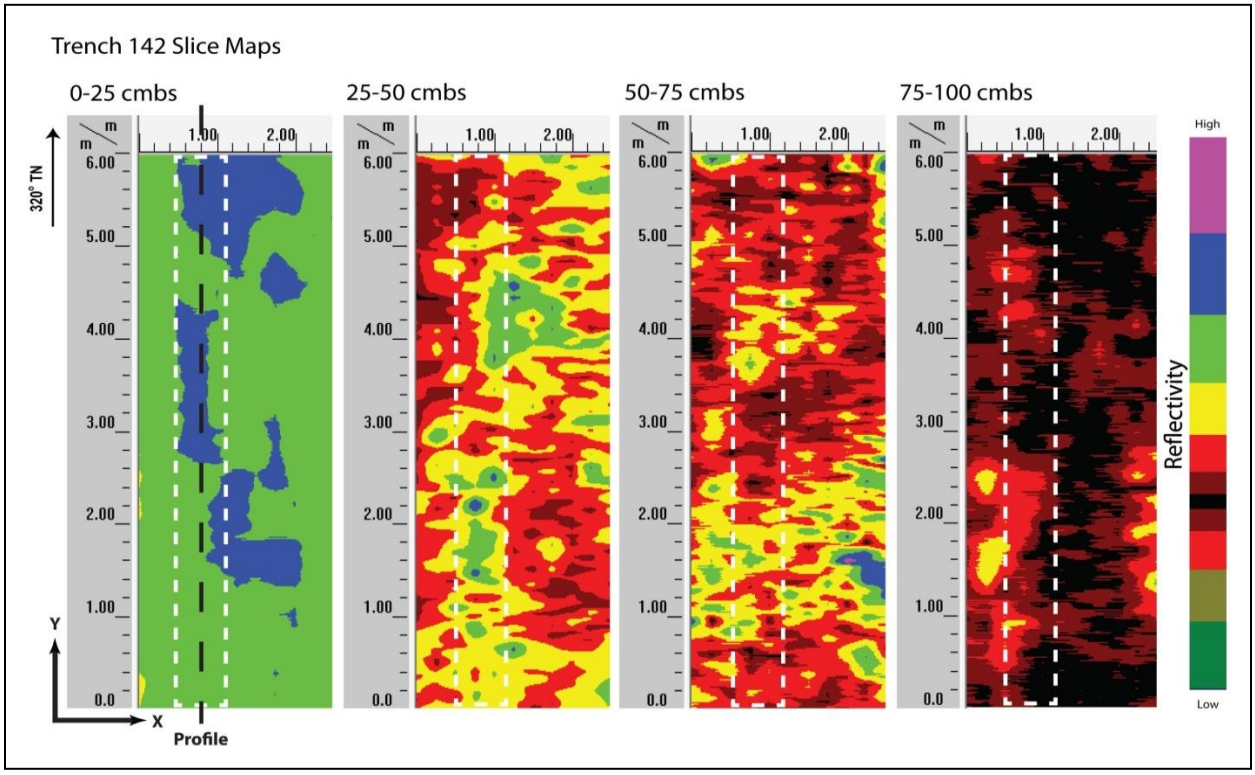

Figure 63. Slice maps of T-142 at 25cm depth intervals

A visual comparison of the excavated profile and the GPR signal profile showed a moderate correlation in stratigraphic transitions (Figure 64). Strata Ia to Ib were all clearly observed and occured near the ground-truthed depths. Strata included: asphalt, very gravelly silty loam fill, gravelly to cobbly sand fill, natural sandy loam, jaucus sand, and clayey sand. An intact human burial was found 1.0- 1.12 mbs. No other discrete objects or other stratigraphic transitions were observed in the GPR results or subsequent excavation.

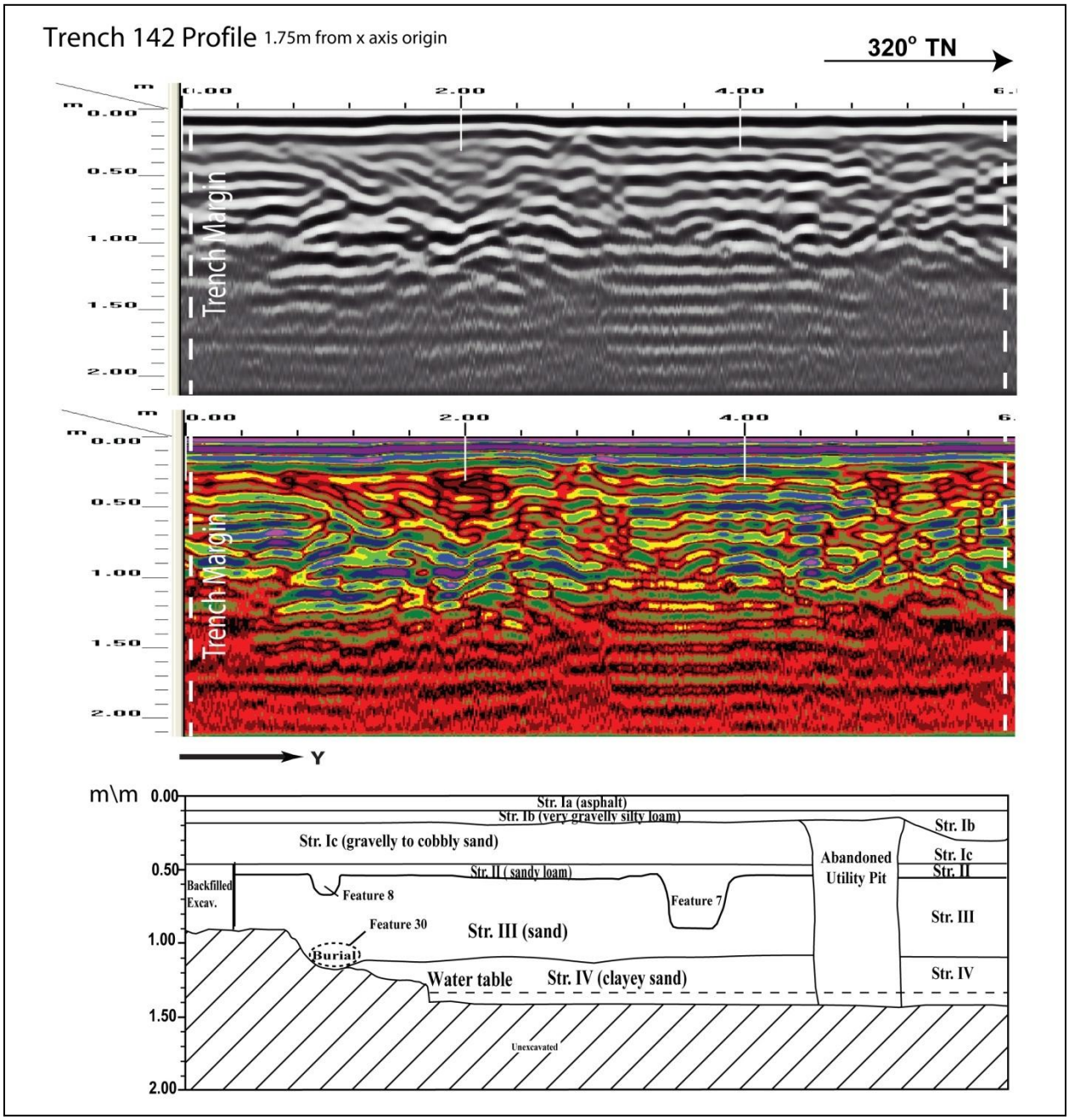

Figure 64. Visual comparison of excavated profile and GPR signal profile of T-142

Test Excavation 143

T-143 measured 0.9 m by 3.0 m and was oriented northwest to southeast and was located within the road cut of Halekauwila Street, 45.0 m southeast of Halekauwila Street and Keawe Street intersection. The GPR grid measured 3.0 m by 7.0 m with 0.25 m spacing between Y transects and 1.0 m spacing between X transects. Utilities located near the excavation include: water line 1.0 m southwest and 1.1 m southeast, gas line 2.5 m northeast, and sewer line 3.2 m northeast. No utilities transected the GPR grid or excavation location.

A review of amplitude slice maps indicated a linear feature but it was not encountered during excavation. Reflectivity was relatively uniform throughout the grid and decreased with depth. A transition from higher reflectivity to lower reflectivity was observed at approximately 0.75 mbs (Figure 65).

GPR depth profiles for T-143 identified horizontal banding, commonly associated with stratigraphic layering, throughout the survey area (Figure 66). This banding corresponded to variations of density and chemical composition within fill deposits. The profile also indicated a change in reflectivity that occurred around 0.25 mbs. An anomaly was observed in the profile but not within the excavation boundaries. The maximum depth of clean signal return was approximately 0.8 mbs.

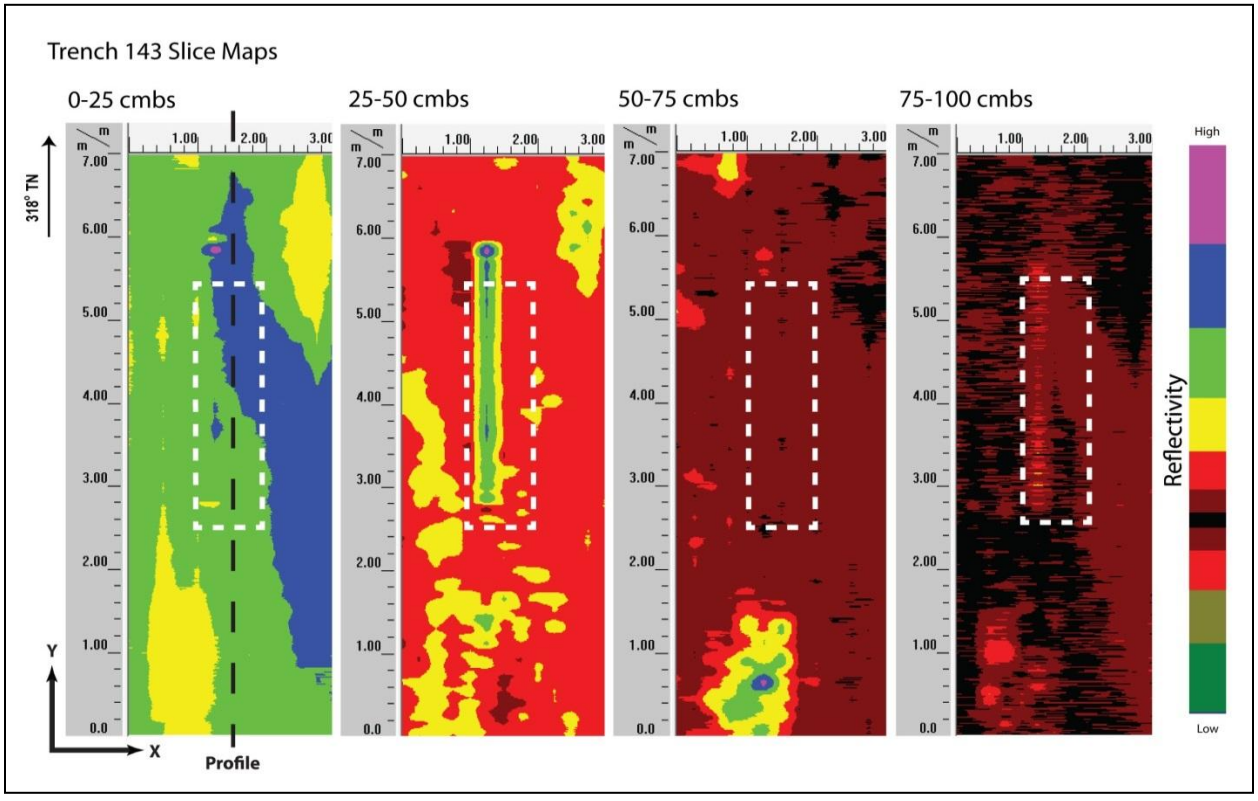

Figure 65. Slice maps of T-143 at 25cm depth intervals

A visual comparison of the excavated profile and the GPR signal profile showed a strong correlation in stratigraphic transitions (Figure 66). Strata Ia to Id were clearly observed and occured at the ground-truthed depths. All other sediment transitions were below the maximum clean signal return depth. No discrete objects were observed in the GPR results or subsequent excavation.

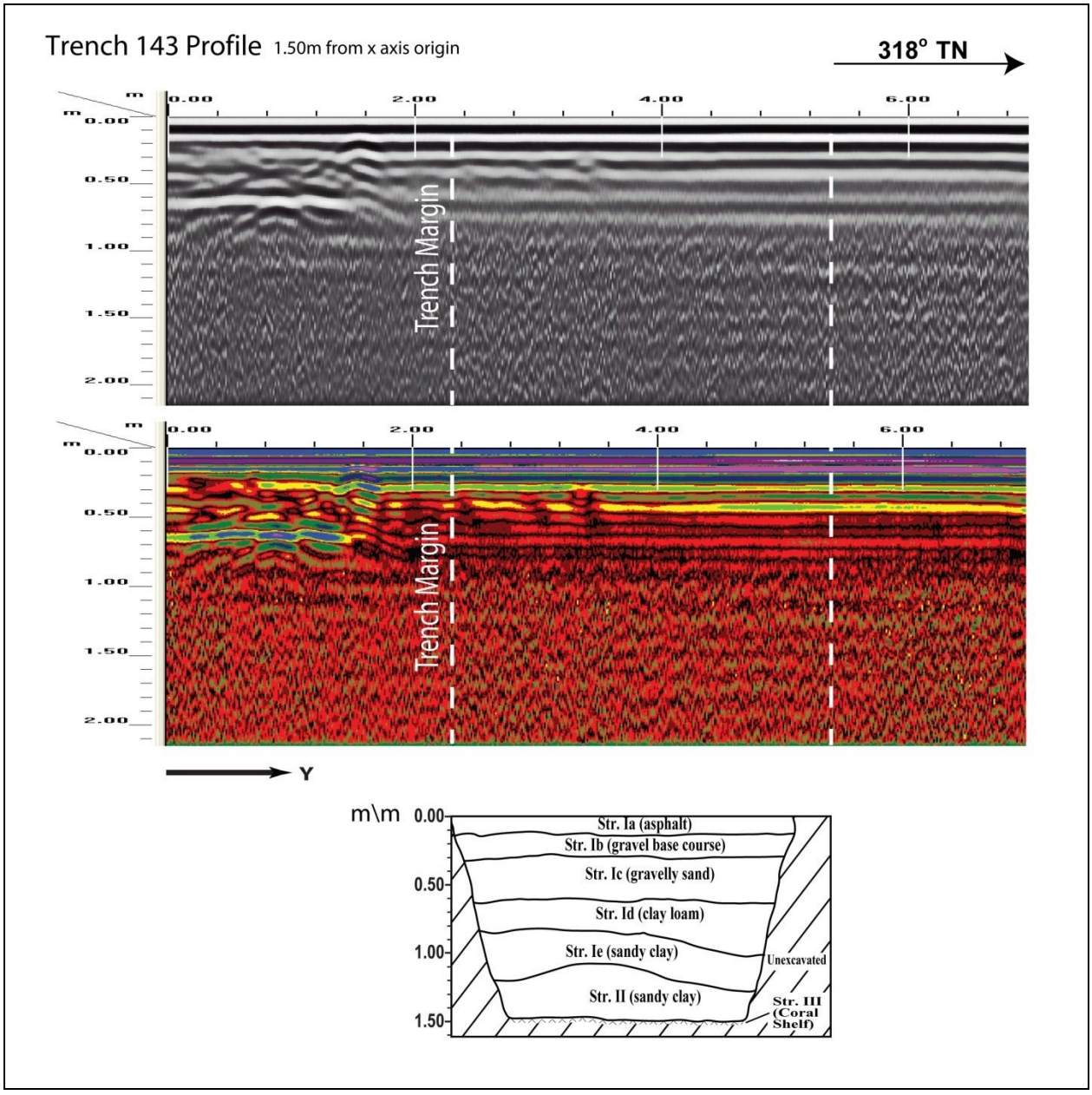

Figure 66. Visual comparison of excavated profile and GPR signal profile of T-143

Test Excavation 144

T-144 measured 0.9 m by 3.0 m and was oriented northwest to southeast and was located within the sidewalk southwest of Halekauwila Street, 26.0 m northwest of Halekauwila Street and Coral Street intersection. The GPR grid measured 2.0 m by 6.0 m with 0.25 m spacing between Y transects and 1.0 m spacing between X transects. Utilities located near the excavation include: electrical line 1.2 m northeast, water line 1.8 m northeast. A concrete jacket was encountered 0.5 mbs in the northwest end and covered the majority of the excavation.

A review of amplitude slice maps indicated a linear feature but it was not encountered during excavation but a concrete jacket was encountered. Reflectivity was relatively uniform throughout the grid and decreased with depth except for the linear feature. A transition from higher reflectivity to lower reflectivity was observed at approximately 0.25 mbs (Figure 67).

GPR depth profiles for T-144 identified horizontal banding, commonly associated with stratigraphic layering, throughout the survey area (Figure 68). This banding corresponded to variations of density and chemical composition within fill deposits. The profile also indicated a change in reflectivity that occurred around 0.3 mbs. No utilities were observed in the profile although a concrete jacket was encountered during excavation. The maximum depth of clean signal return was approximately 0.9 mbs.

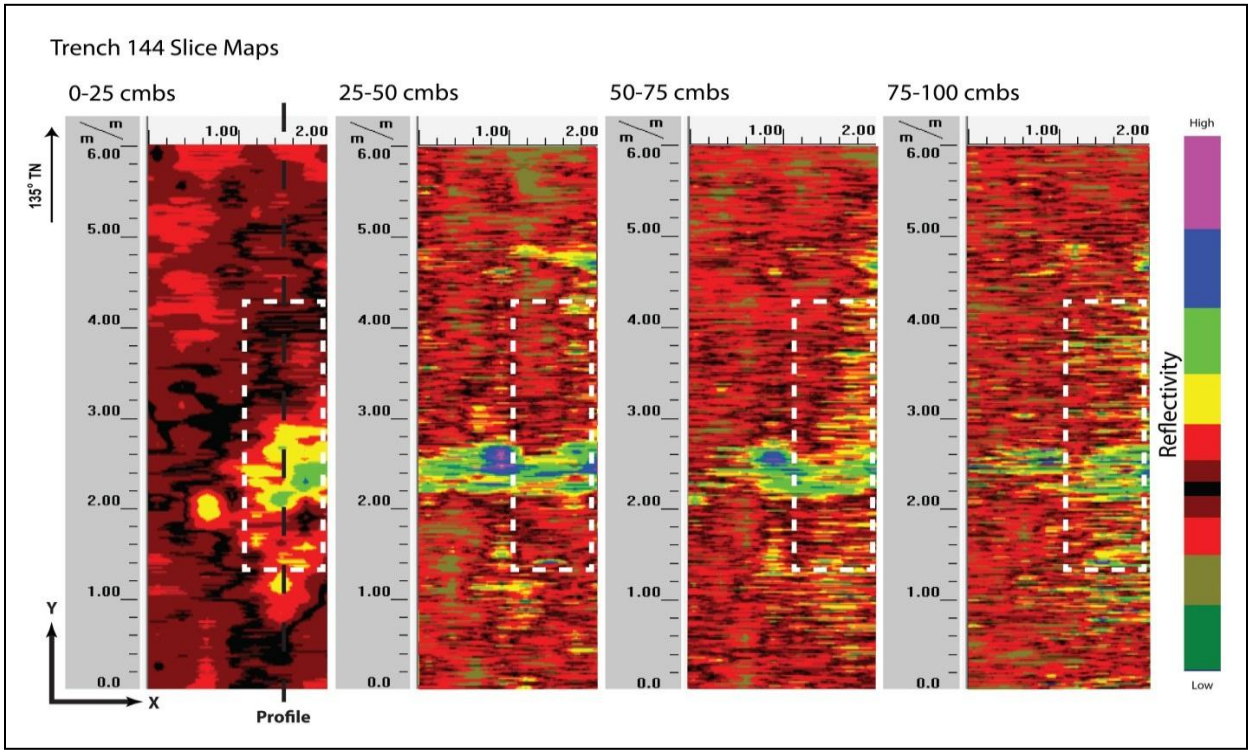

Figure 67. Slice maps of T-144 at 25cm depth intervals

A visual comparison of the excavated profile and the GPR signal profile showed a moderate correlation in stratigraphic transitions (Figure 68). Strata Ia to Ib were all clearly observed but do not occured near the ground-truthed depths. A concrete jacket was found 0.5 mbs. The jacket did not showed up on the profile or slice maps. This may be due to the fact that the concrete was not reinforced with steel (rebar) or that the jacket had a similar density to the surrounding stratum. No other discrete objects or other stratigraphic transitions were observed in the GPR results or subsequent excavation.

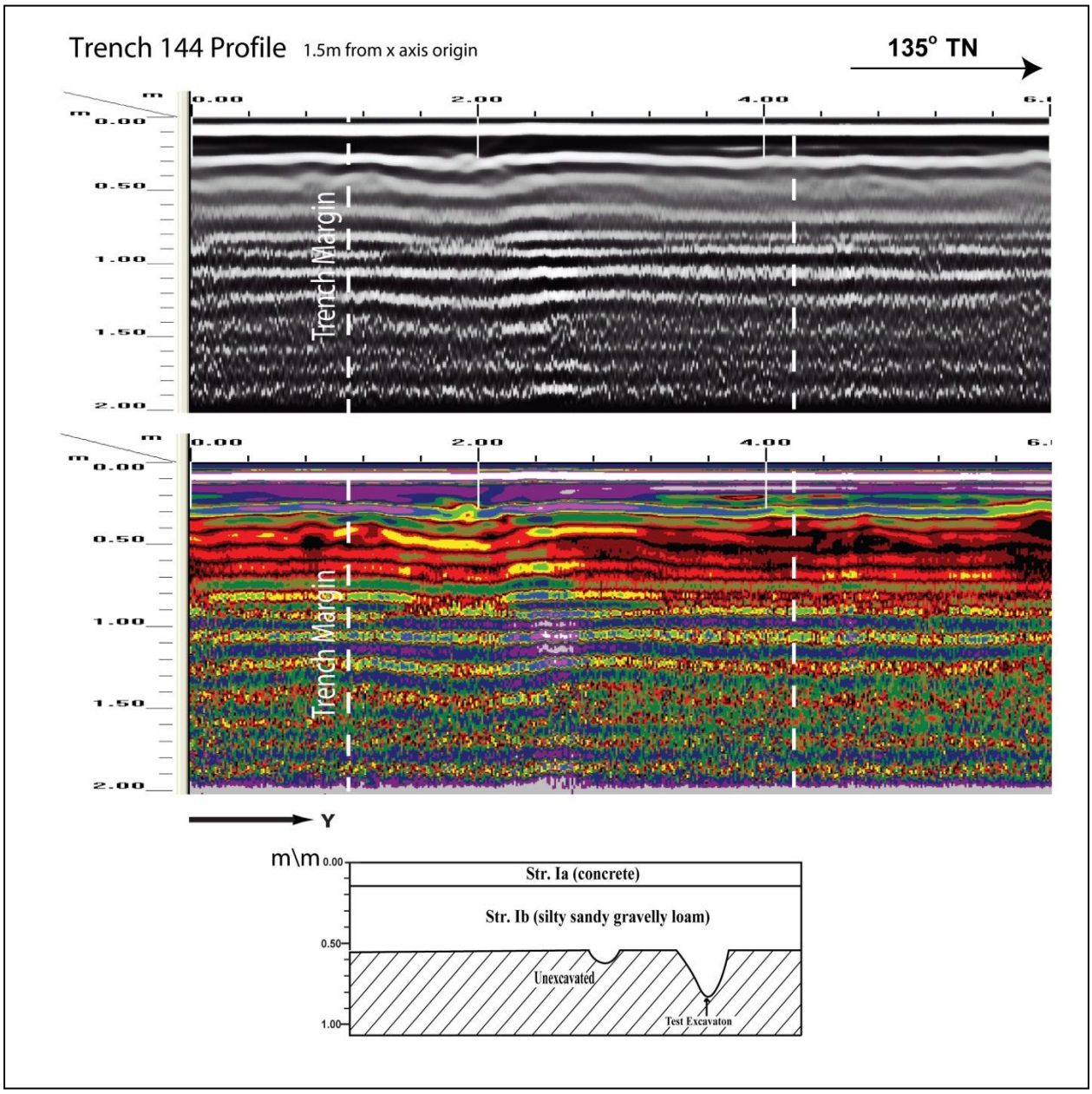

Figure 68. Visual comparison of excavated profile and GPR signal profile of T-144

Test Excavation 145

T-145 measured 0.9 m by 3.0 m and was oriented northwest to southeast and was located within the road cut of Halekauwila Street, 25.0 m northwest of Halekauwila Street and Coral Street intersection. The GPR grid measured 3.0 m by 6.0 m with 0.25 m spacing between Y transects and 1.0 m spacing between X transects. Utilities located near the excavation include: water line one m southwest, electrical line 2.7 m southwest, and gas line 2.5 m northeast. No utilities transected the excavation location.

A review of amplitude slice maps indicated a linear feature but not within the excavation location. Reflectivity was relatively uniform throughout the grid and decreased with depth except for the linear feature. A transition from higher reflectivity to lower reflectivity was observed at approximately 0.75 mbs (Figure 69).

GPR depth profiles for T-145 identified horizontal banding, commonly associated with stratigraphic layering, throughout the survey area (Figure 70). This banding corresponded to variations of density and chemical composition within fill deposits. The profile also indicated a change in reflectivity that occurred around 0.2 mbs. No utilities were observed in the profile. The maximum depth of clean signal return was approximately 1.0 mbs.

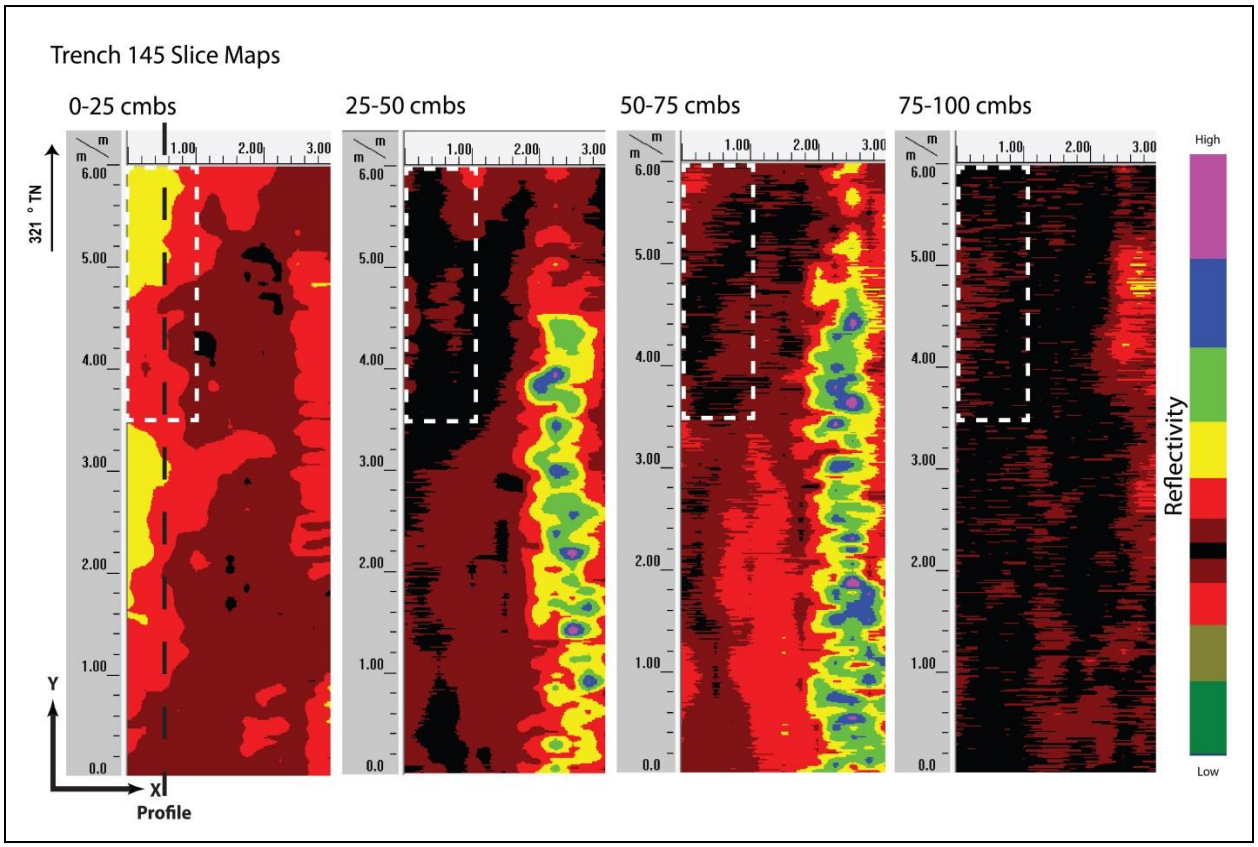

Figure 69. Slice maps of T-145 at 25cm depth intervals

A visual comparison of the excavated profile and the GPR signal profile showed a moderate correlation in stratigraphic transitions (Figure 70). Strata Ia to Ib were all clearly observed and occured near the ground-truthed depths. Strata Ic and Id were observable but it was not possible to observe the transition on the GPR profile. All other sediment transitions were below the maximum clean signal return depth. No discrete objects were observed in the GPR results or subsequent excavation.

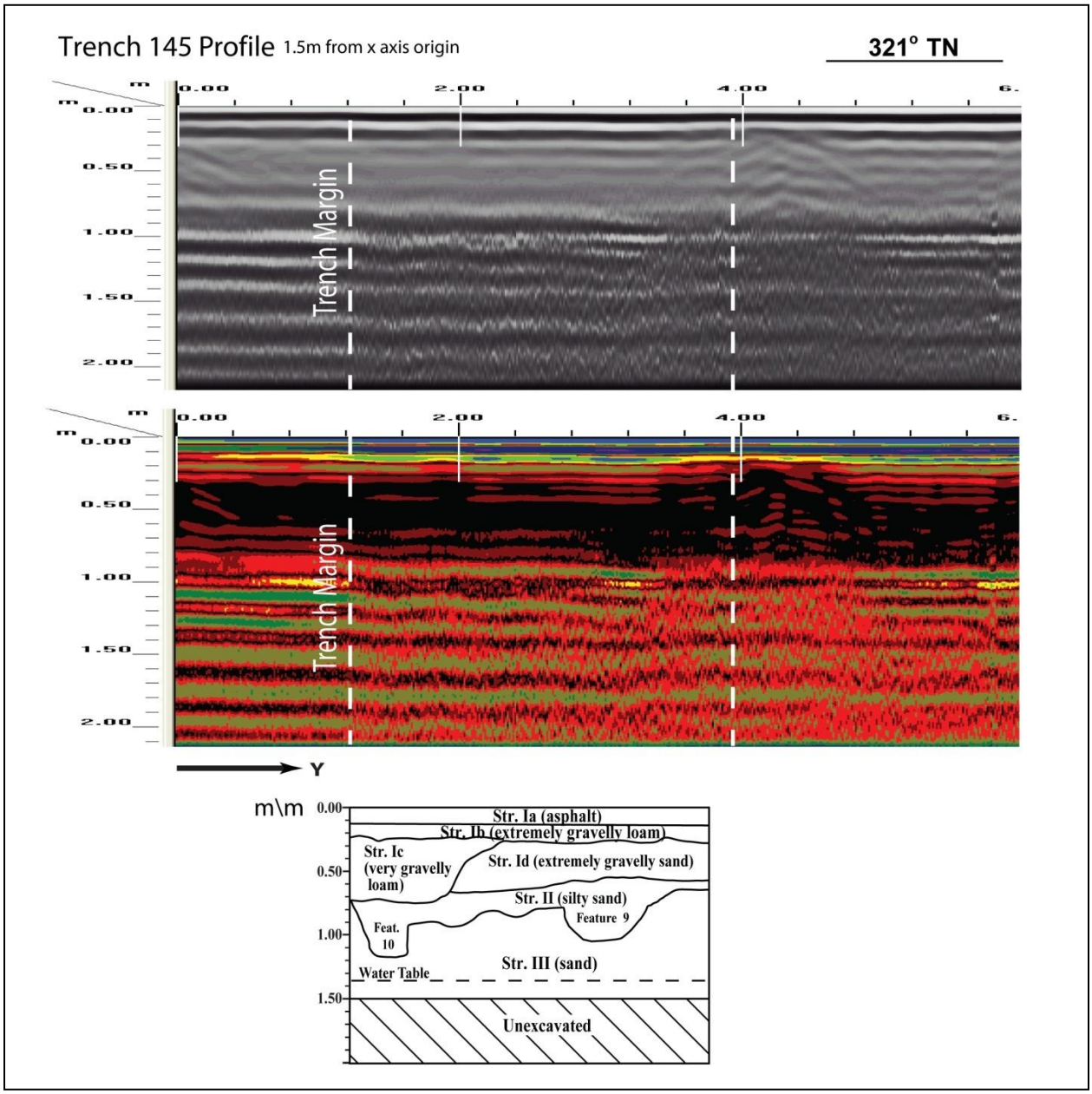

Figure 70. Visual comparison of excavated profile and GPR signal profile of T-145.

Test Excavation 146

T-146 measured 0.9 m by 3.0 m and was oriented northwest to southeast and was located within the sidewalk southwest of Halekauwila Street, 20.0 m south of Halekauwila Street and Coral Street intersection. The GPR grid measured 1.5 m by 6.0 m with 0.25 m spacing between Y transects and 1.0 m spacing between X transects. Utilities located near the excavation include: electrical line 0.8 m northeast. A PVC pipe was encountered 0.33 mbs in the southeastern end and a concrete slab was encountered 0.4 mbs and spanned the entire length of the excavation.

A review of amplitude slice maps indicated a linear feature that seems to corresponded to the concrete slab that was encountered. Reflectivity was relatively uniform throughout the grid and decreased with depth. A transition from higher reflectivity to lower reflectivity was observed at approximately 0.5 mbs (Figure 71).

GPR depth profiles for T-146 identified horizontal banding, commonly associated with stratigraphic layering, throughout the survey area (Figure 72). This banding corresponded to variations of density and chemical composition within fill deposits. The profile also indicated a change in reflectivity that occurred around 0.25 mbs. An anomaly was observed in the profile and corresponded to the PVC pipe that was encountered during excavation. The maximum depth of clean signal return was approximately 1.0 mbs.

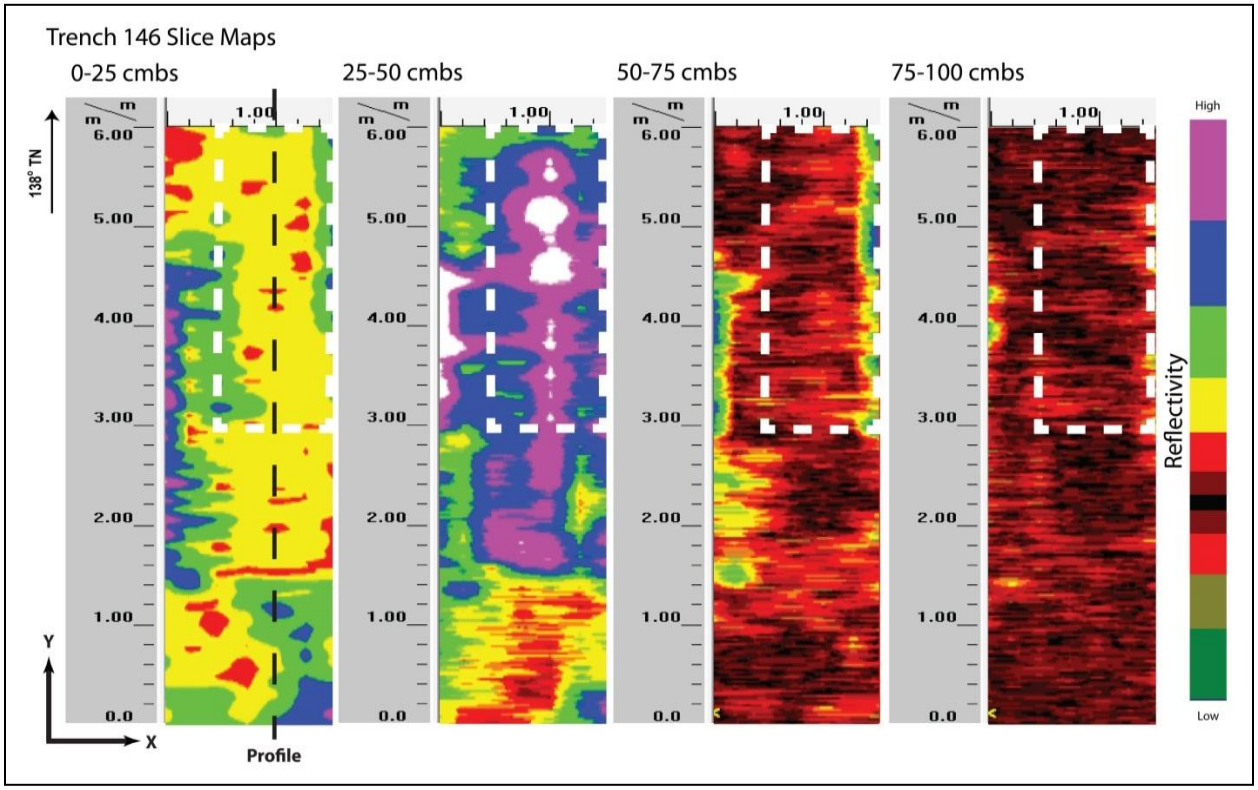

Figure 71. Slice maps of T-146 at 25cm depth intervals

A visual comparison of the excavated profile and the GPR signal profile showed a strong correlation in stratigraphic transitions (Figure 72). Strata Ia and Ib were clearly observed and occured at the ground-truthed depths. Textural changes in the form of multiple small hyperbolas were apparent in Stratum Ib which was gravelly to cobbly sand. A PVC pipe and concrete slab were found 0.33 and 0.4 mbs, respectively. The pipe and jacket corresponded to anomalies seen in the profile. No other discrete objects or stratigraphic transitions were observed in the GPR results or subsequent excavation.

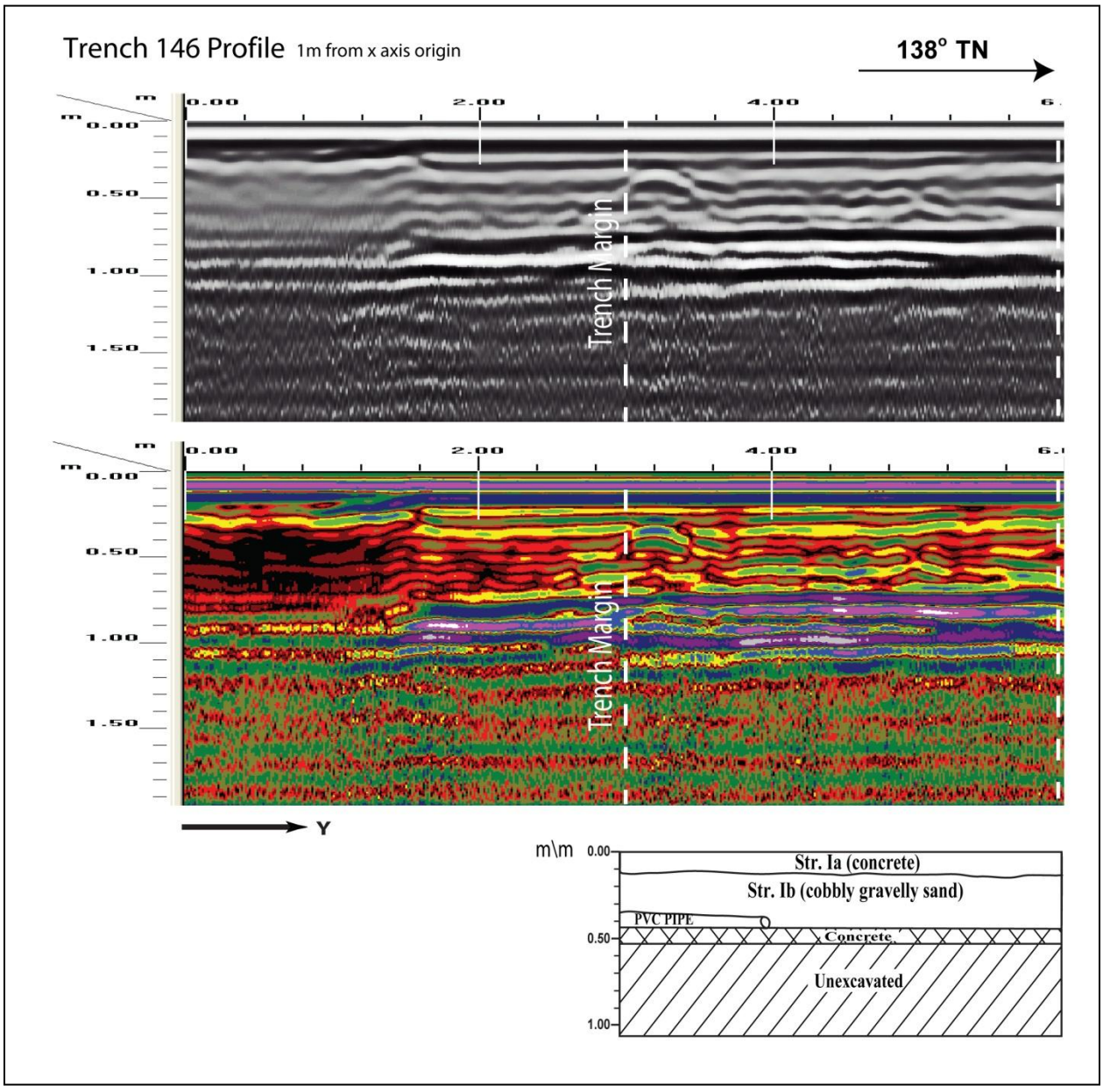

Figure 72. Visual comparison of excavated profile and GPR signal profile of T-146

Test Excavation 146A

T-146A measured 0.9 m by 3.0 m and was oriented northwest to southeast and was located within the sidewalk northeast of Halekauwila Street, 19.0 m southeast of Halekauwila Street and Coral Street intersection. The GPR grid measured 1.5 m by 5.0 m with 0.25 m spacing between Y transects and 1.0 m spacing between X transects. Utilities located near the excavation include: electrical line parallel to southwest wall and 0.8 m northeast, sewer line two m southwest, gas line three m southwest, storm drain 3.2 m northwest, water line 3.8 m southwest. A concrete utility jacket was encountered 0.1 mbs and was within the northeastern wall of the excavation.

A review of amplitude slice maps indicated a linear feature which was a storm drain and was not within excavation boundaries. Reflectivity was relatively uniform throughout the grid and decreased with depth except for the storm drain. A transition from higher reflectivity to lower reflectivity was observed at approximately 0.25 mbs (Figure 73).

GPR depth profiles for T-146A identified horizontal banding, commonly associated with stratigraphic layering, throughout the survey area (

Figure 74). This banding corresponded to variations of density and chemical composition within fill deposits. The profile also indicated a change in reflectivity that occurred around 0.2 mbs. An anomaly was observed in the profile but not within the excavation boundaries. The maximum depth of clean signal return was approximately 1.10 mbs.

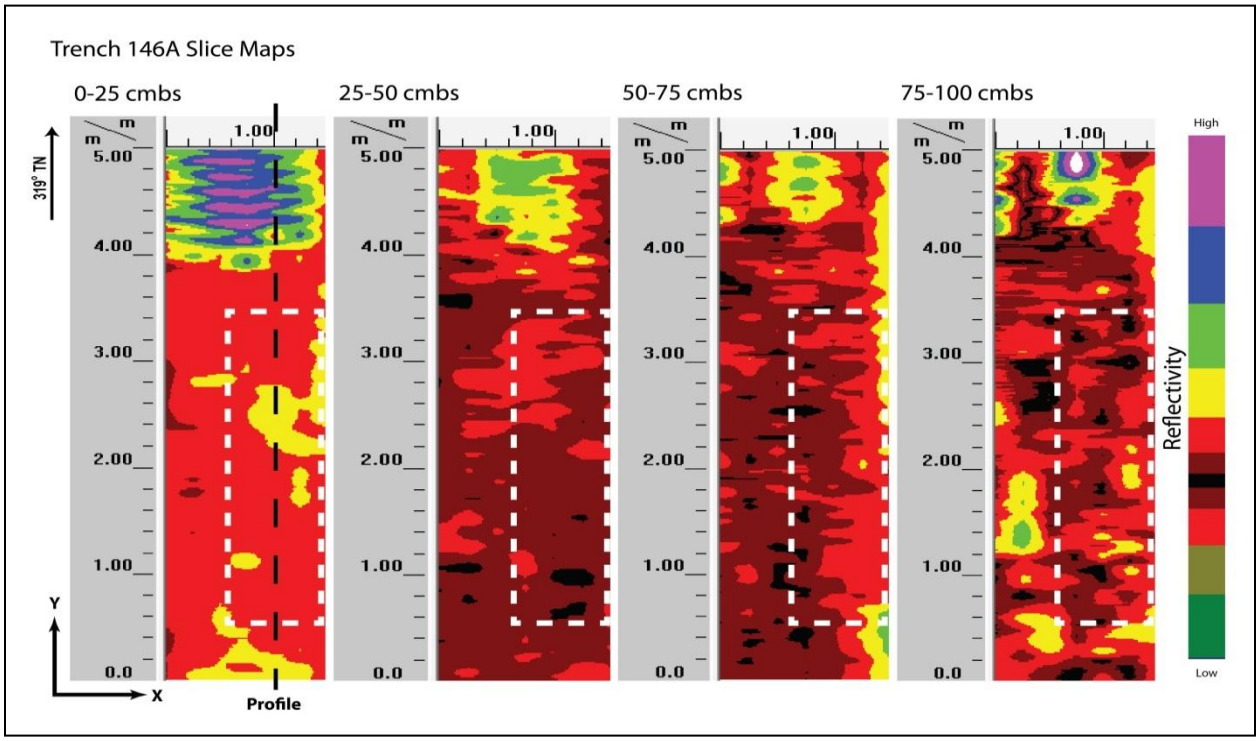

Figure 73. Slice maps of T-146A at 25cm depth intervals

A visual comparison of the excavated profile and the GPR signal profile showed a strong correlation in stratigraphic transitions (

Figure 74). Strata Ia to III were clearly observed and occured at the ground-truthed depths. Strata include: concrete, gravelly sandy loam fill, concrete, natural very sandy loam, natural sand, and decomposing coral shelf. No discrete objects or other stratigraphic transitions were observed in the GPR results or subsequent excavation.

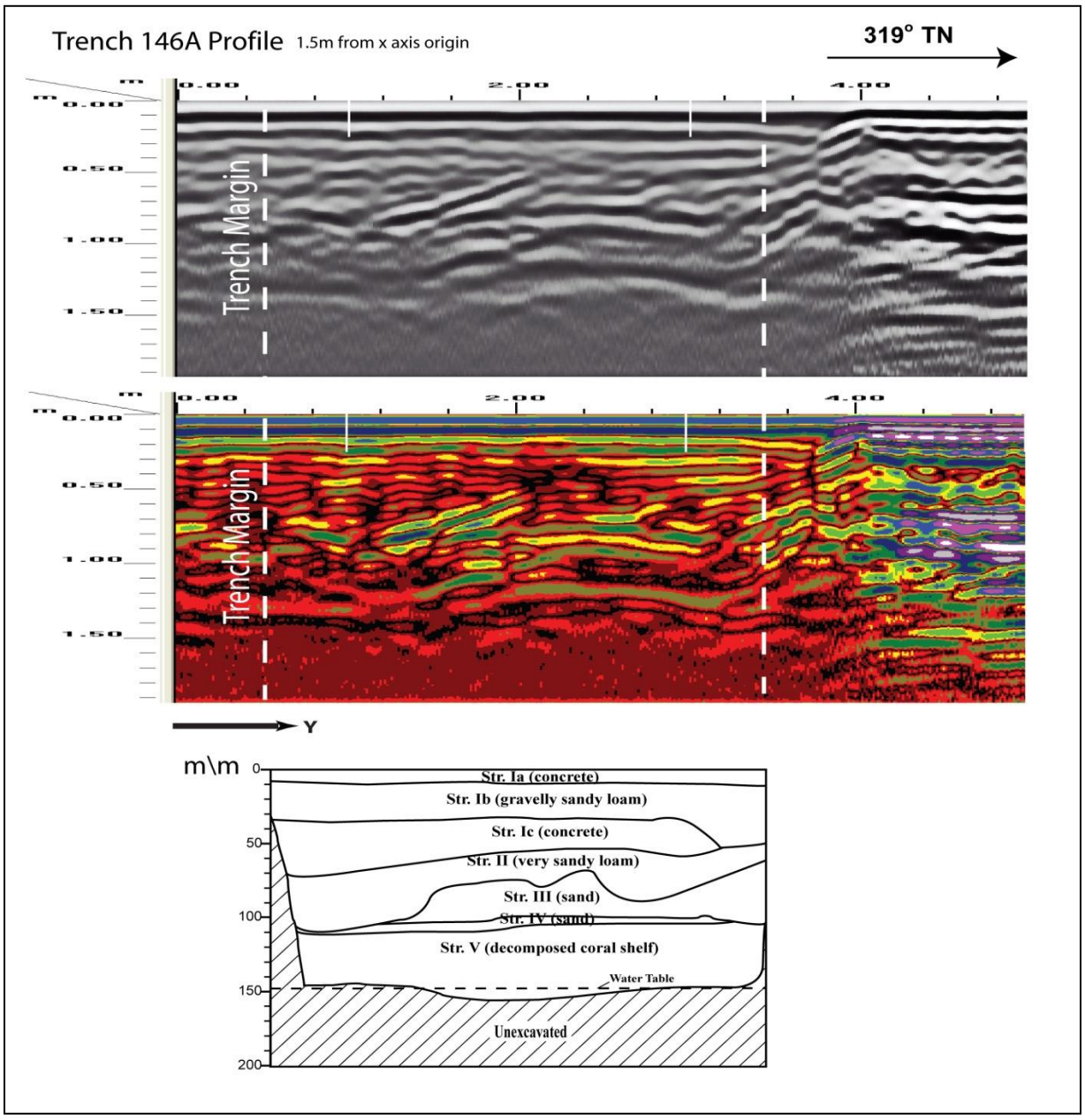

Figure 74. Visual comparison of excavated profile and GPR signal profile of T-146A

Test Excavation 147

T-147 measured 0.6 m by 6.0 m and was oriented northwest to southeast and was located within the sidewalk southwest of Halekauwila Street, 23.0 m southeast of Halekauwila Street and Coral Street intersection. The GPR grid measured 2.5 m by 6.0 m with 0.25 m spacing between Y transects and 1.0 m spacing between X transects. Utilities located near the excavation include: electrical line 0.5 m southwest. A concrete drain box was encountered 0.47 mbs along the entire northeastern side of the excavation.

A review of amplitude slice maps indicated no linear features although a concrete drain box was encountered during excavation. Reflectivity was relatively uniform throughout the grid and decreased with depth. A transition from higher reflectivity to lower reflectivity was observed at approximately 0.5 mbs (Figure 75).

GPR depth profiles for T-147 identified horizontal banding, commonly associated with stratigraphic layering, throughout the survey area (Figure 76). This banding corresponded to variations of density and chemical composition within fill deposits. The profile also indicated a change in reflectivity that occurred around 0.2 mbs. No utilities were observed in the profile although a concrete drain box was encountered during excavation. The maximum depth of clean signal return was approximately 1.0 mbs.

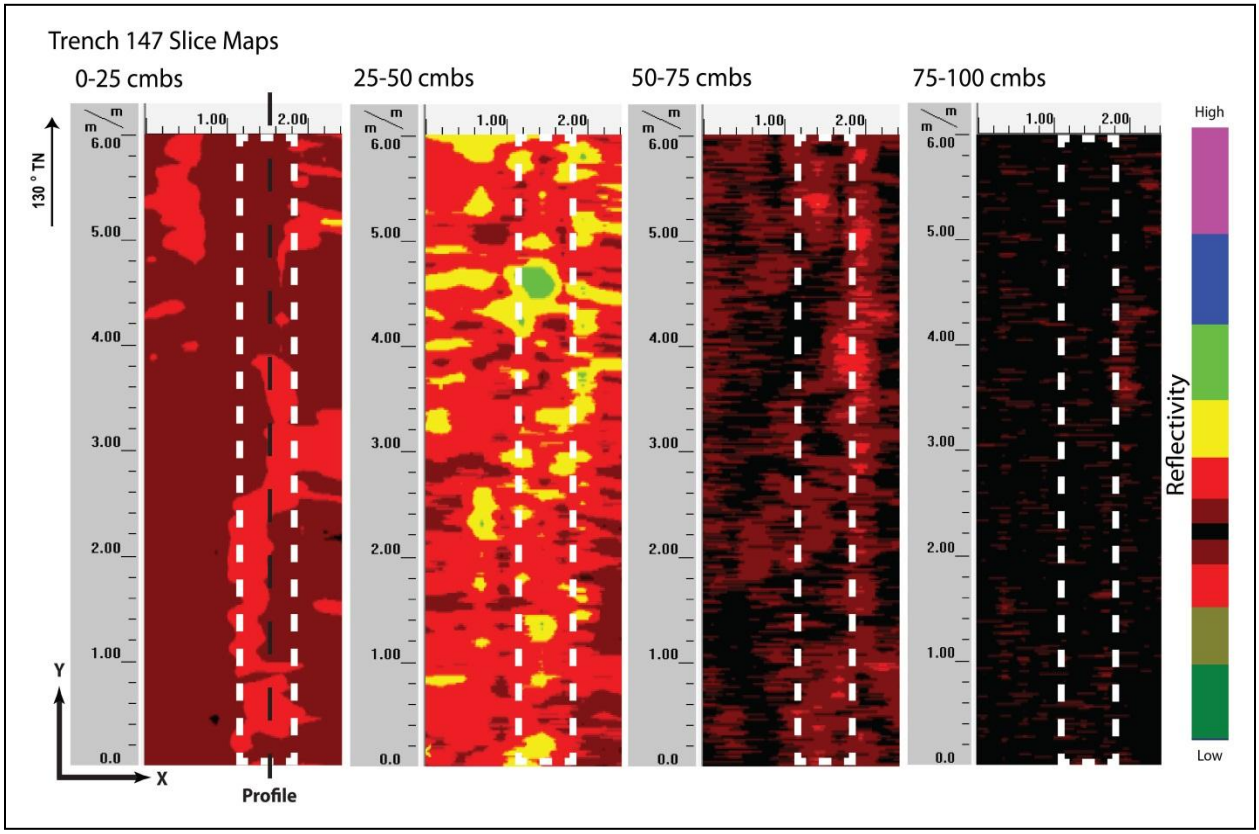

Figure 75. Slice maps of T-147 at 25cm depth intervals

A visual comparison of the excavated profile and the GPR signal profile showed a moderate correlation in stratigraphic transitions (Figure 76). Strata Ia, Ib, Id and Ie were all clearly observed and occured near the ground-truthed depths. Strata included: asphalt, gravelly sandy loam fill, very gravelly loamy sand fill, gravelly loamy sand fill, and sandy clay loam fill A drain box was found 0.47 mbs. This drain box did not showed up on the profile or slice maps. No other discrete objects or stratigraphic transitions were observed in the GPR results or subsequent excavation.

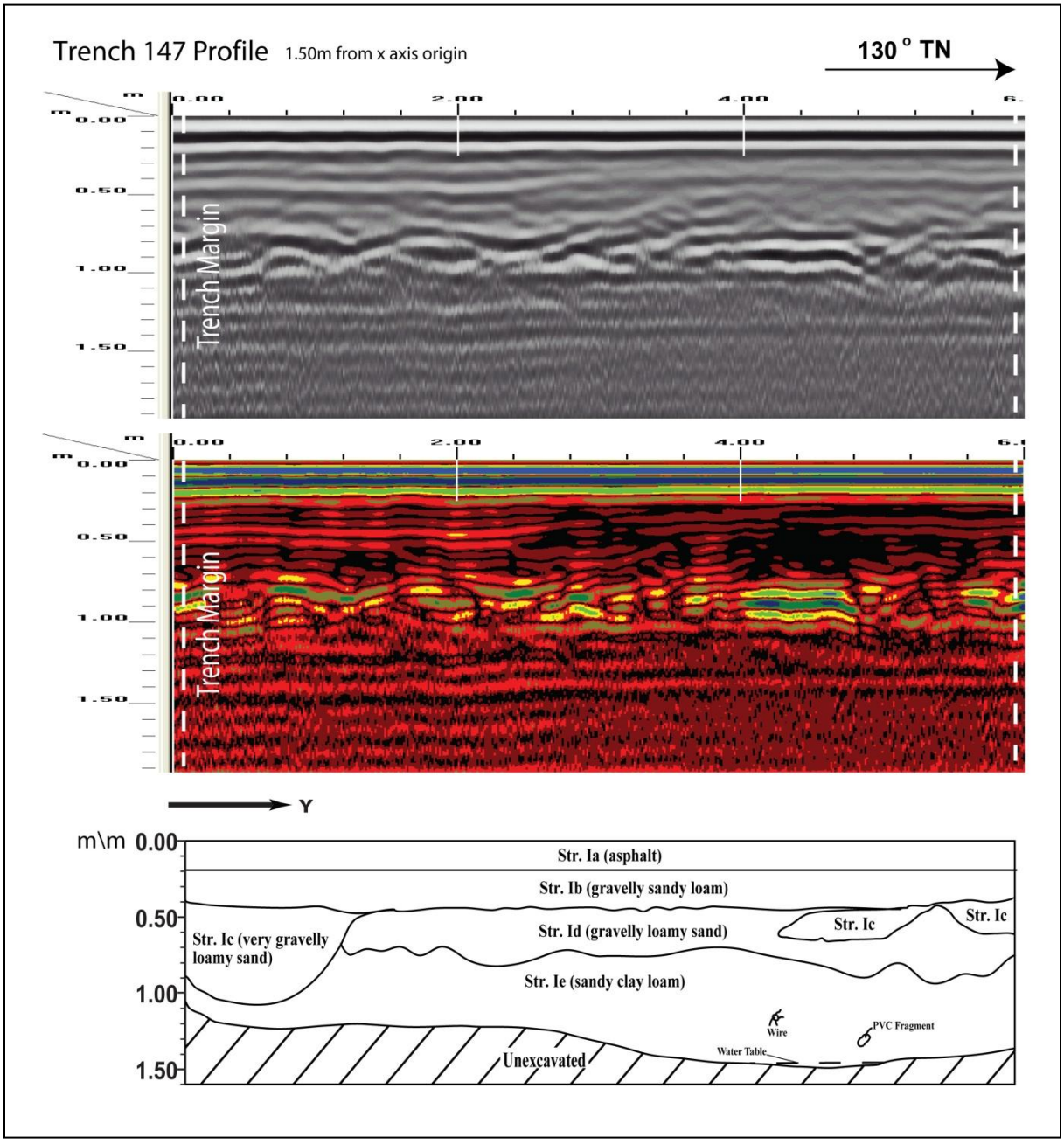

Figure 76. Visual comparison of excavated profile and GPR signal profile of T-147

Test Excavation 148

T-148 measured 0.9 m by 3.0 m and was oriented northwest to southeast and was located within the sidewalk southwest of Halekauwila Street, 19.0 m northwest of Halekauwila Street and Cooke Street intersection. The GPR grid measured 3.0 m by 6.0 m with 0.25 m spacing between Y transects and 1.0 m spacing between X transects. Utilities located near the excavation include: water drain 0.2 m east and 4.5 m northeast, electrical line 0.5 m northeast. A concrete slab was encountered 0.51 mbs on the northwestern end and several PVC pipes were encountered 0.46-0.52 mbs and were adjacent to the concrete slab.

A review of amplitude slice maps indicated linear features but not within excavaion boundaries. Reflectivity was relatively uniform throughout the grid and decreased with depth except for the linear features. A transition from higher reflectivity to lower reflectivity was observed at approximately 0.5 mbs (Figure 77).

GPR depth profiles for T-148 identified horizontal banding, commonly associated with stratigraphic layering, throughout the survey area (

Figure 78). This banding corresponded to variations of density and chemical composition within fill deposits. The profile also indicated a change in reflectivity that occurred around 0.4 mbs. No utilities were observed in the profile although several were encountered during excavation. The maximum depth of clean signal return was approximately 1.0 mbs.

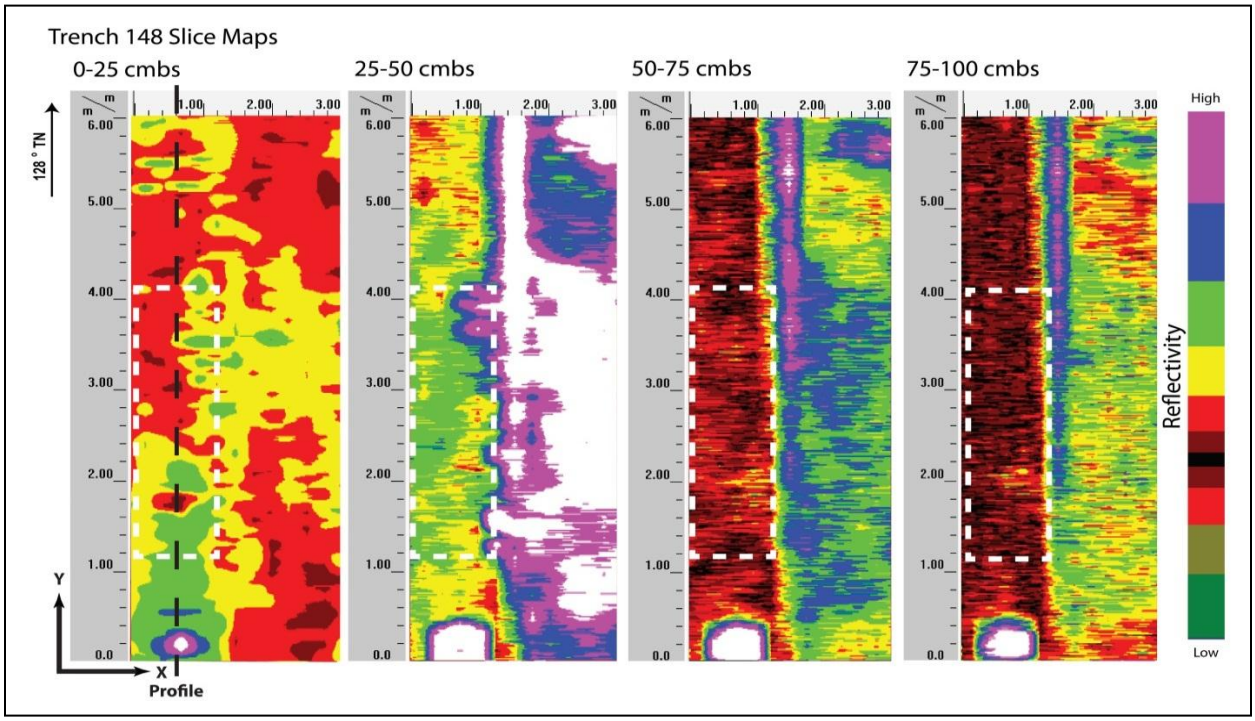

Figure 77. Slice maps of T-148 at 25cm depth intervals

A visual comparison of the excavated profile and the GPR signal profile showed a moderate correlation in stratigraphic transitions (

Figure 78). Strata I and II were clearly observed but do not occured near the ground-truthed depths. A concrete slab and several PVC pipes were found 0.51 and 0.46-0.52 mbs. respectively. The concrete slab and PVC pipes did not showed up on the profile or slice maps. No discrete objects or other stratigraphic transitions were observed in the GPR results or subsequent excavation.

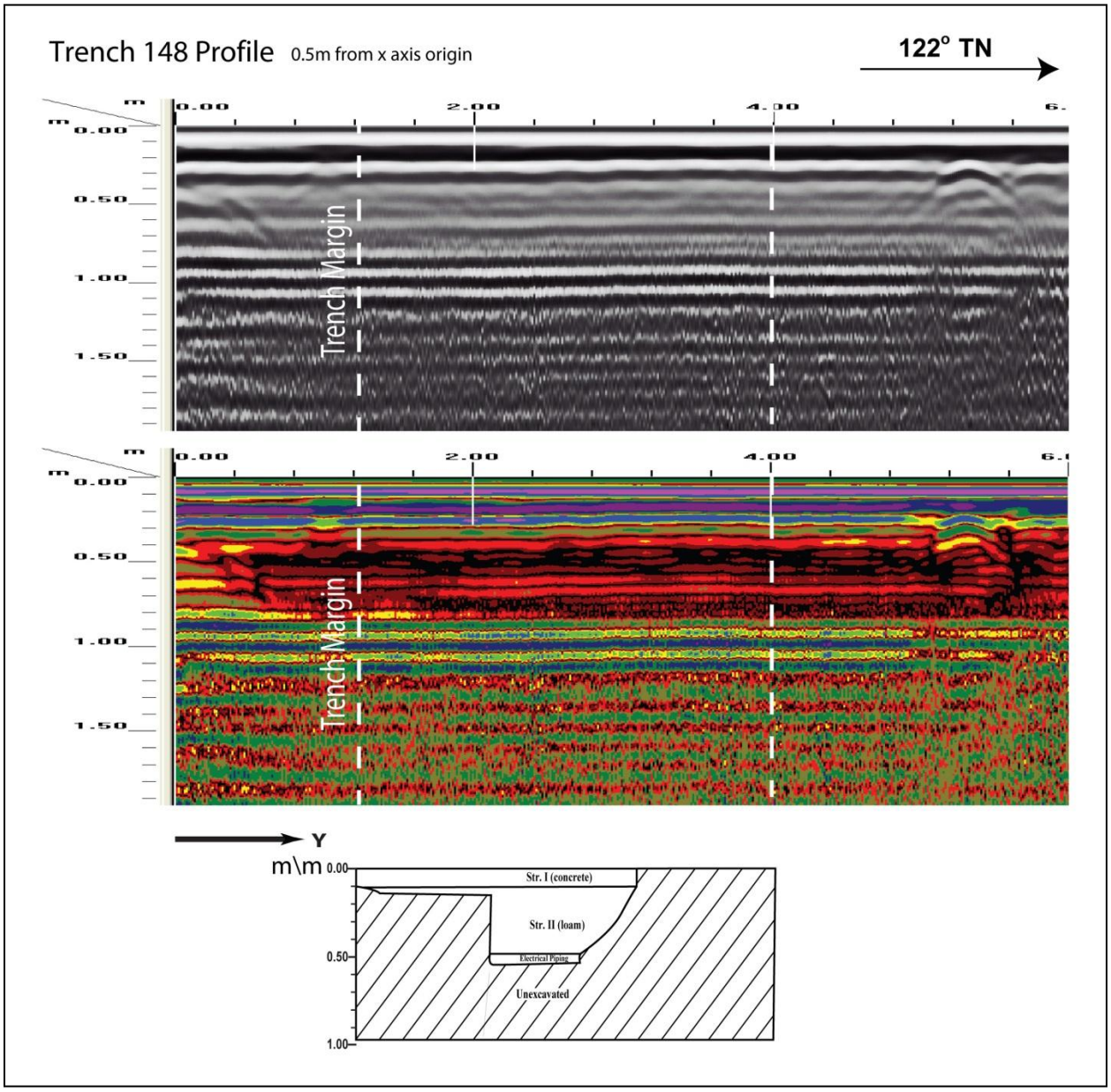

Figure 78. Visual comparison of excavated profile and GPR signal profile of T-148

Test Excavation 148A

T-148A measured 0.6 m by 2.6 m and was oriented northwest to southeast and was located within the sidewalk northeast of Halekauwila Street, 18.0 m northwest of Halekauwila Street and Cooke Street intersection. The GPR grid measured 1.5 m by 5.0 m with 0.25 m spacing between Y transects and 1.0 m spacing between X transects. Utilities located near the excavation include: electrical line within the excavation and 2.15 m northeast, sewer line 2.3 m southwest, gas line 3.3 m southwest, water line 4 m southwest. A concrete jacket was encountered 1.15 mbs and spanned the entire length of the excavation.

A review of amplitude slice maps indicated no linear features although a concrete jacket was encountered during excavation. Reflectivity was relatively uniform throughout the grid and decreased with depth. A transition from higher reflectivity to lower reflectivity was observed at approximately 0.75 mbs (

Figure 79).

GPR depth profiles for T-148A identified horizontal banding, commonly associated with stratigraphic layering, throughout the survey area (Figure 80). This banding corresponded to variations of density and chemical composition within fill deposits. The profile also indicated a change in reflectivity that occurred around 0.2 mbs. The maximum depth of clean signal return was approximately 1.0 mbs.

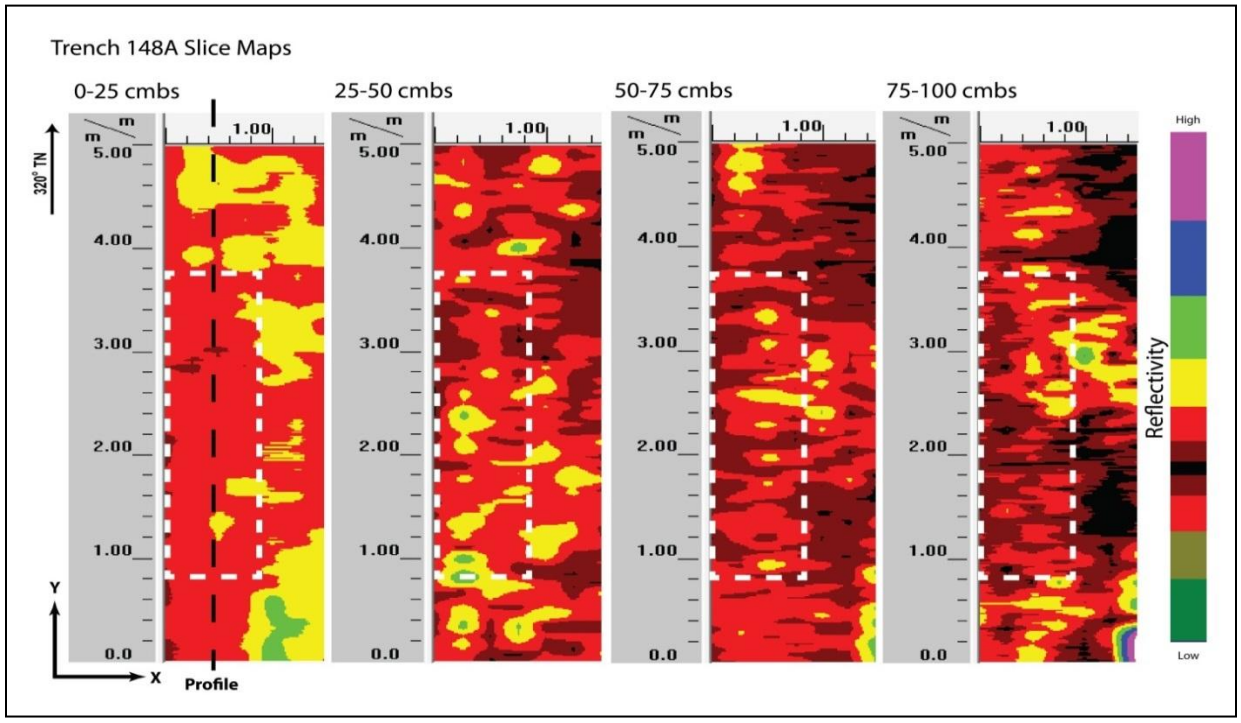

Figure 79. Slice maps of T-148A at 25cm depth intervals

A visual comparison of the excavated profile and the GPR signal profile showed a strong correlation in stratigraphic transitions (Figure 80). Strata Ia and Ib were clearly observed and occured at the ground-truthed depths. Textural changes in the form of multiple small hyperbolas were apparent in Stratum Ib which was gravelly sandy clay loam fill. A concrete jacket was found 1.15 mbs. This did not showed up on the profiles or slice maps because it was below the maximum clean signal return depth. No other discrete objects or stratigraphic transitions were observed in the GPR results or subsequent excavation.

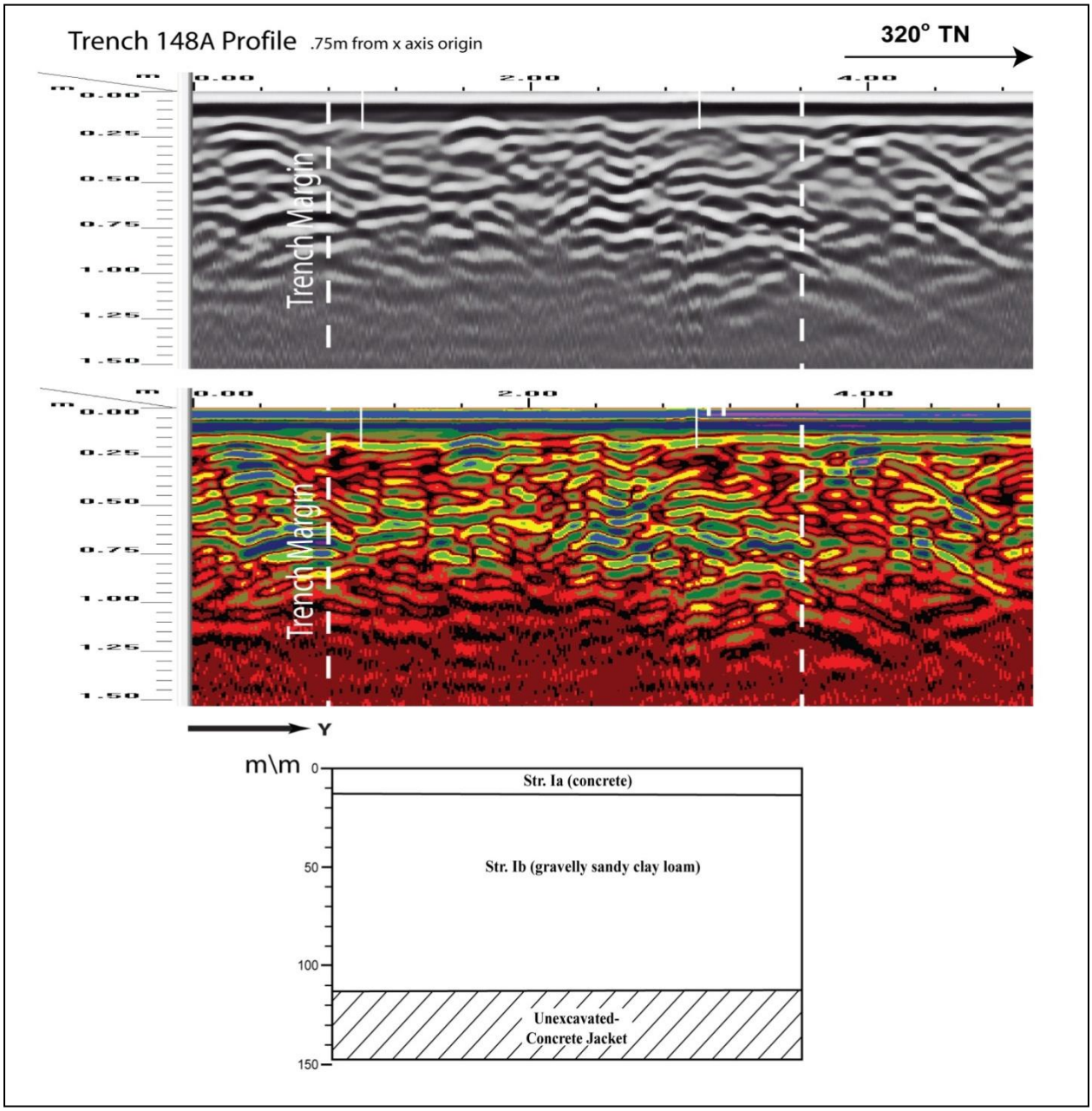

Figure 80. Visual comparison of excavated profile and GPR signal profile of T-148A

Test Excavation 149

T-149 measured 0.6 m by 6.0 m and was oriented northeast to southwest and was located within the sidewalk on Halekauwila Street, 15.0 m east of Halekauwila Street and Cooke Street intersection. The GPR grid measured 3.0 m by 10.0 m with 0.25 m spacing between Y transects and 1.0 m spacing between X transects. Utilities located near the excavation include: electrical line 1.0 m west, sewer line 4.8 m west, water line 1.6 m southwest. A utility jacket was encountered approximately 0.18 mbs in the northern end of the excavation.

A review of amplitude slice maps indicated no linear features although a utility jacket was encountered during excavation. Reflectivity was relatively uniform throughout the grid and decreased with depth. A transition from higher reflectivity to lower reflectivity was observed at approximately 0.5 mbs (Figure 81).

GPR depth profiles for T-149 identified horizontal banding, commonly associated with stratigraphic layering, throughout the survey area (Figure 82). This banding corresponded to variations of density and chemical composition within fill deposits. The profile also indicated a change in reflectivity that occurred around 0.35 mbs. Several anomalies were observed on the profile and one seems to corresponded to the utility jacket encountered during excavation. The maximum depth of clean signal return was approximately 1.15 mbs.

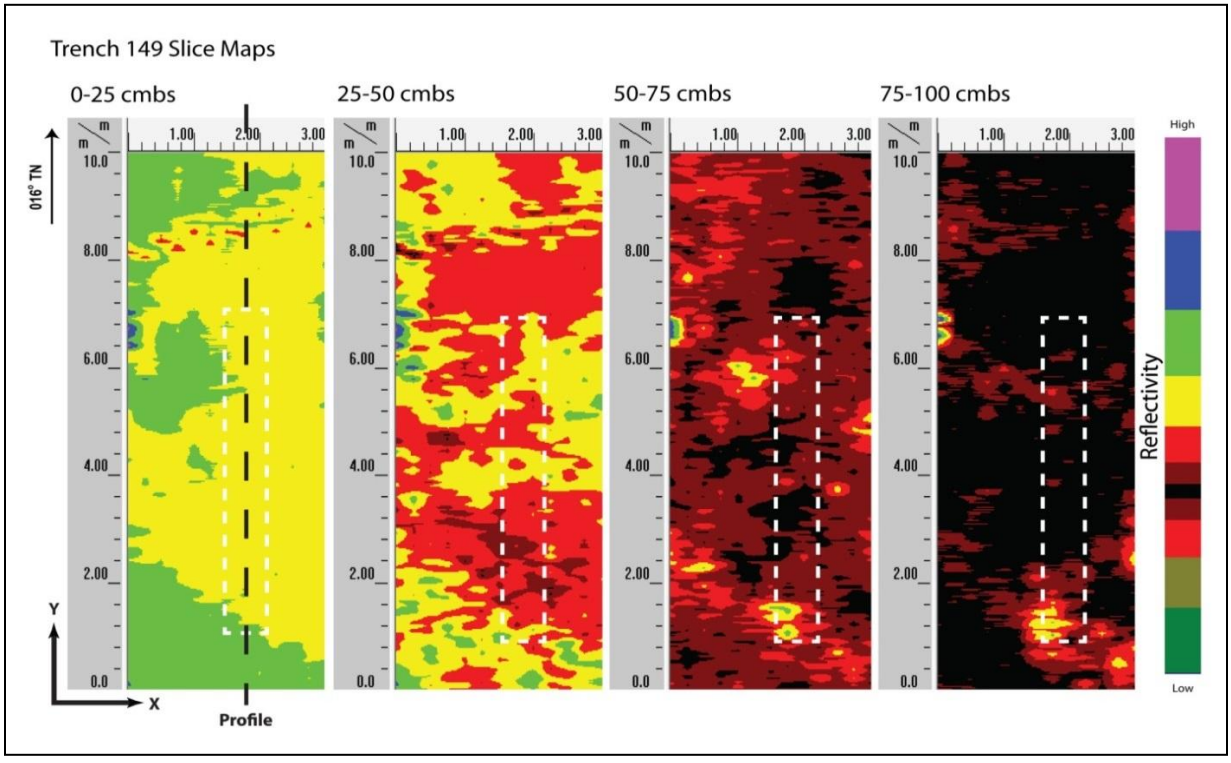

Figure 81. Slice maps of T-149 at 25cm depth intervals

A visual comparison of the excavated profile and the GPR signal profile showed a moderate correlation in stratigraphic transitions (Figure 82). Strata Ia to Ic and Id were all clearly observed and occured near the ground-truthed depths. Strata Ia to Ic may be difficult to individually discern, possibly due to the fact that they were very thin layers of compacted fill, but based on reflectivity and horizontal banding it was apparent that there were multiple layers of fill events. A utility jacket was found 0.18 mbs. The utility jacket corresponded with an anomaly observed in the profile. No discrete objects were observed in the GPR results or subsequent excavation.

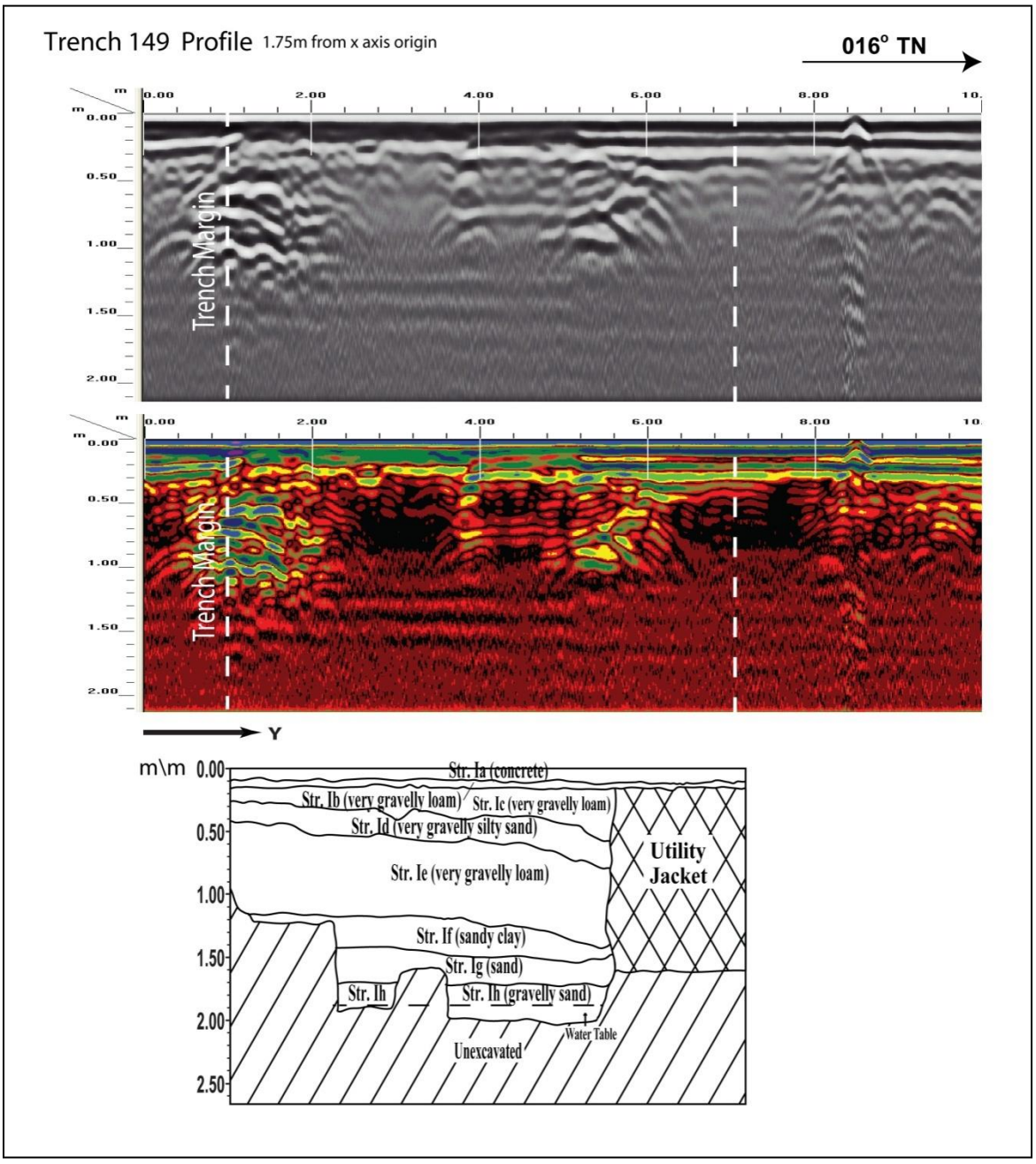

Figure 82. Visual comparison of excavated profile and GPR signal profile of T-149

Test Excavation 150

T-150 measured 0.6 m by 6.0 m and was oriented northwest to southeast and was located within a sidewalk on Halekauwila Street, 17.0 m southeast of Halekauwila Street and Cooke Street intersection. The GPR grid measured 3.0 m by 10.0 m with 0.25 m spacing between Y transects and 1.0 m spacing between X transects. Utilities located near the excavation include: electrical line 1.6 m west, sewer line 2.0 m west, water drain 5.0 m northeast, gas line 7.0 m northeast. No utilities transected the GPR grid or excavation location although a human skeletal remain fragment was encountered approximately 0.75 mbs in the center of the excavation.

A review of amplitude slice maps indicated no linear features which might indicate the presence of utilities. Reflectivity was relatively uniform throughout the grid and decreased with depth. A transition from higher reflectivity to lower reflectivity was observed at approximately 0.25 mbs and increases again around 0.75 mbs (Figure 83).

GPR depth profiles for T-150 identified horizontal banding, commonly associated with stratigraphic layering, throughout the survey area (Figure 84). This banding corresponded to variations of density and chemical composition within fill deposits. The profile also indicated a change in reflectivity that occurred around 0.2 mbs and again at approximately 0.6 mbs. An anomaly was observed in the profile but was not within excavation boundaries. The maximum depth of clean signal return was approximately 1.1 mbs.

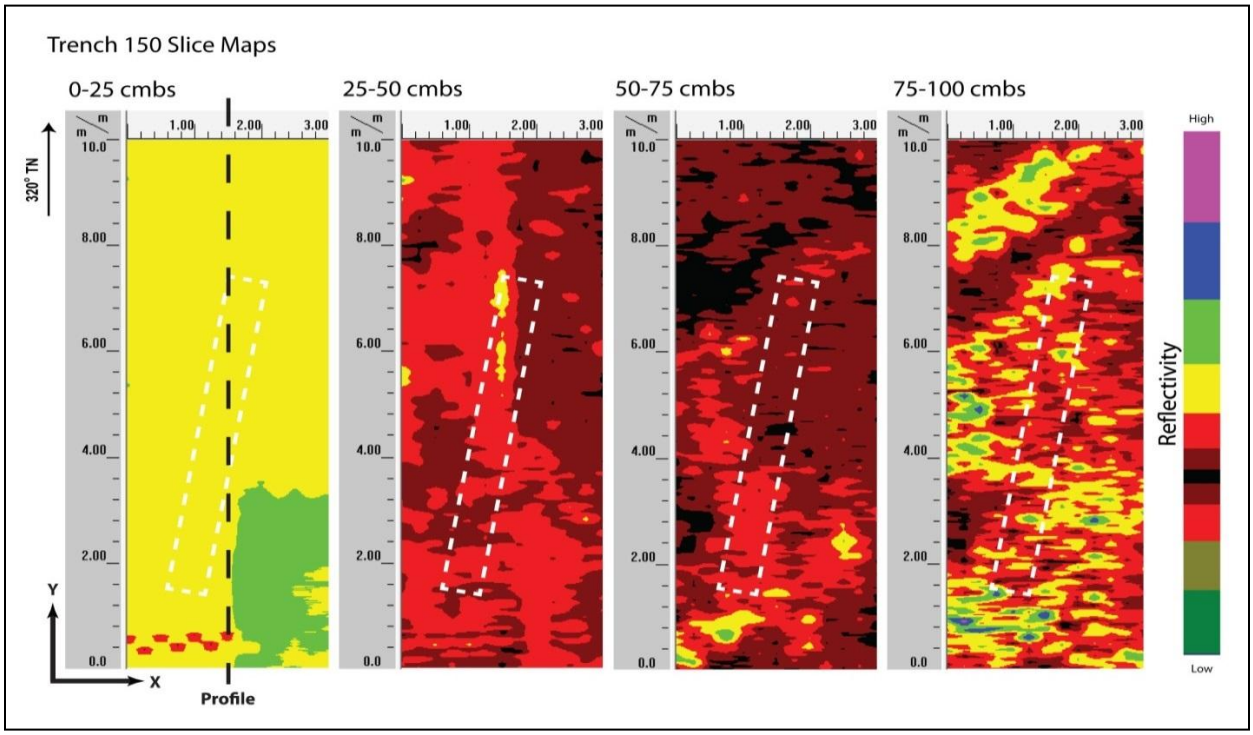

Figure 83. Slice maps of T-150 at 25cm depth intervals

A visual comparison of the excavated profile and the GPR signal profile showed a strong correlation in stratigraphic transitions (Figure 84). Strata Ia to Ic were clearly observed and occured at the ground-truthed depths. Strata included: conrete, extremely gravelly silty clay fill, gravelly silt loam fill, natural loamy sand, and multiple strata of natural sand. No discrete objects or other stratigraphic transitions were observed in the GPR results or subsequent excavation.

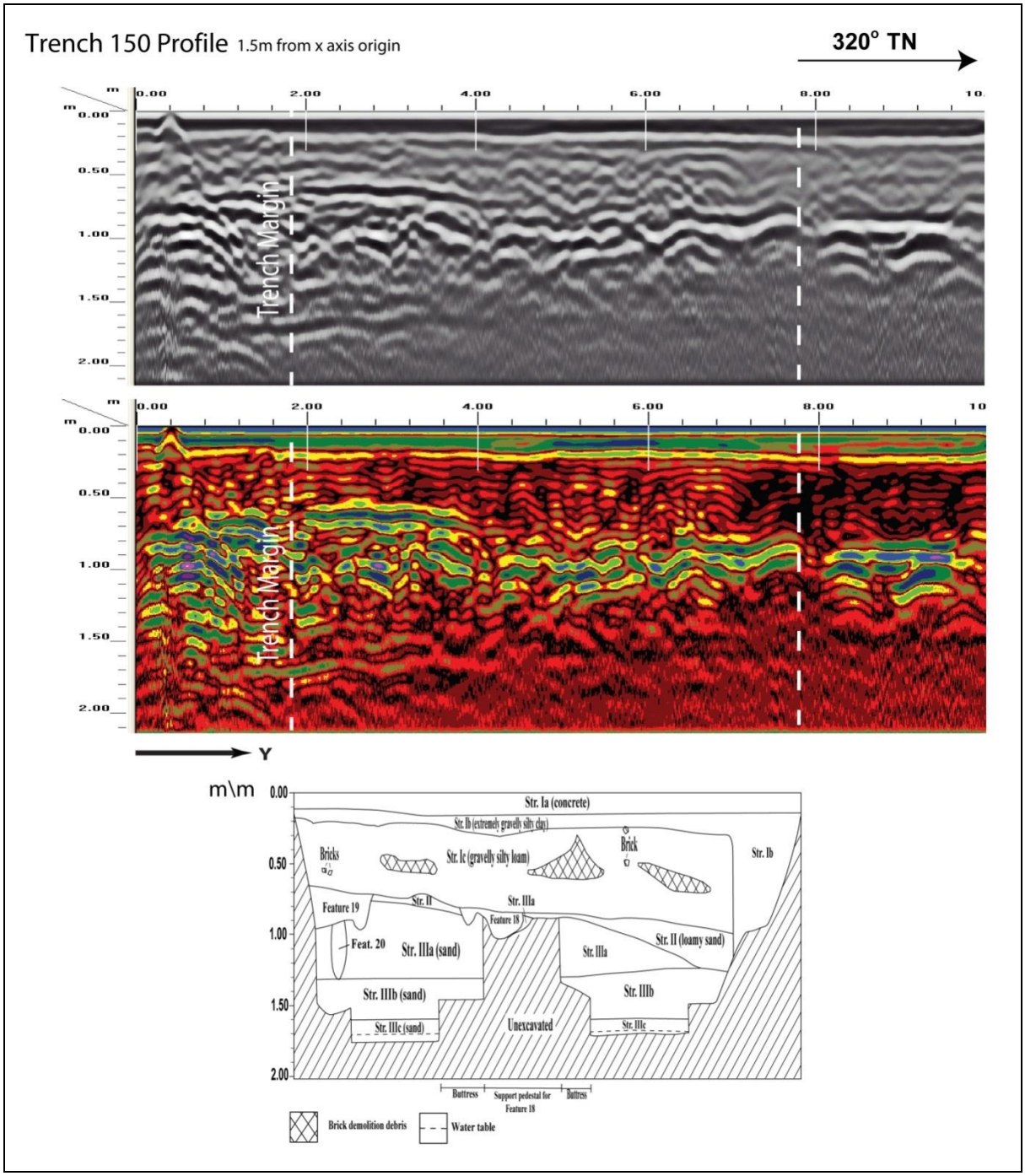

Figure 84. Visual comparison of excavated profile and GPR signal profile of T-150

Test Excavation 151

T-151 measured 0.6 m by 6.0 m and was oriented northwest to southeast and was located within the sidewalk southeast of Halekauwila Street, 15.0 m northwest of Halekauwila Street and Cooke Street intersection. The GPR grid measured 3.0 m by 10.0 m with 0.25 m spacing between Y transects and 1.0 m spacing between X transects. Utilities located near the excavation include: electrical line 2.0 m southwest, water line 3.2 m southwest, water drain 3.2 m northeast. No utilities transected the excavation location.

A review of amplitude slice maps indicated no linear features which might indicate the presence of utilities. Reflectivity was relatively uniform throughout the grid and decreased with depth. A transition from higher reflectivity to lower reflectivity was observed at approximately 0.25 mbs and increases again around 0.75 mbs (Figure 85).

GPR depth profiles for T-151 identified horizontal banding, commonly associated with stratigraphic layering, throughout the survey area (Figure 86). This banding corresponded to variations of density and chemical composition within fill deposits. The profile also indicated a change in reflectivity that occurred around 0.15 mbs and again at approximately 0.6 mbs. No utilities were observed in the profile. The maximum depth of clean signal return was approximately 1.1 mbs.

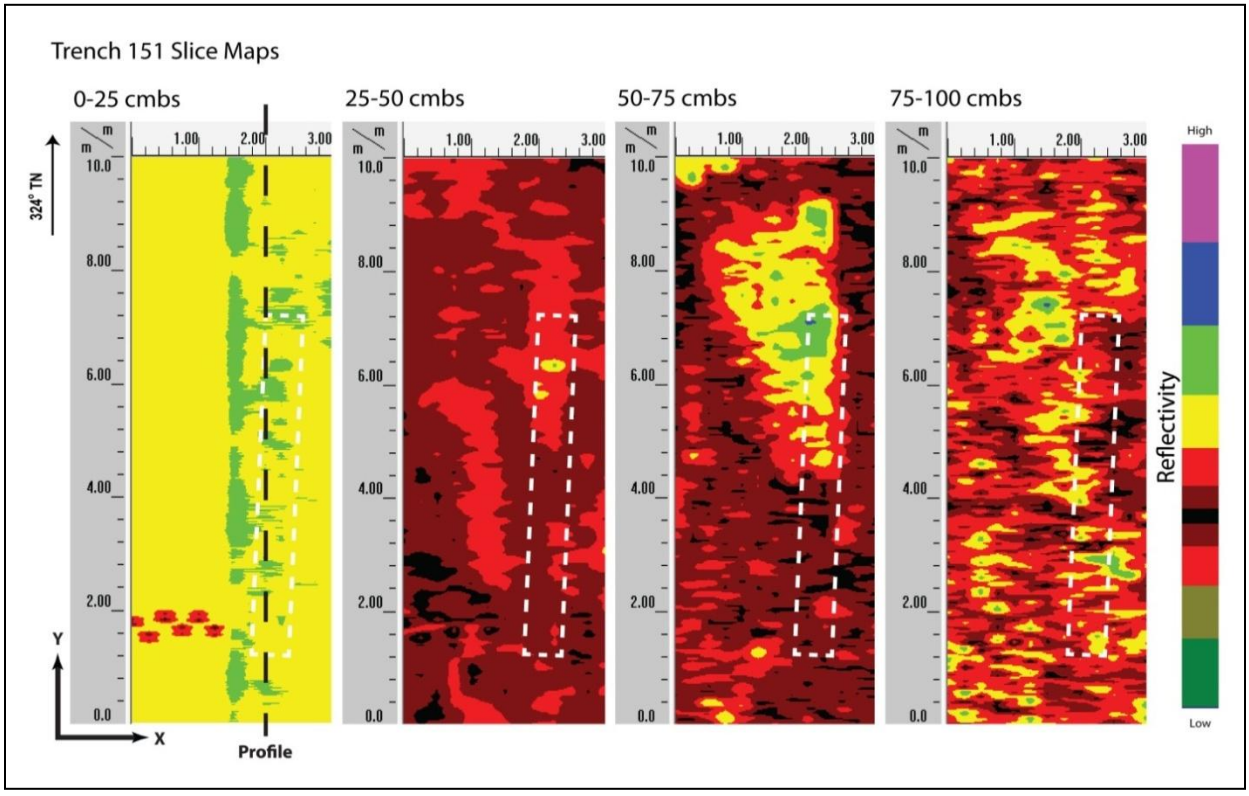

Figure 85. Slice maps of T-151 at 25cm depth intervals

A visual comparison of the excavated profile and the GPR signal profile showed a moderate correlation in stratigraphic transitions (Figure 86). Strata Ia to Id were all clearly observed and occured near the ground-truthed depths. Strata Ib and Ic may be difficult to individually discern because the two layers were composed of very similar material which was why it may be showing up as one layer on the GPR profile. No discrete objects were observed in the GPR results or subsequent excavation.

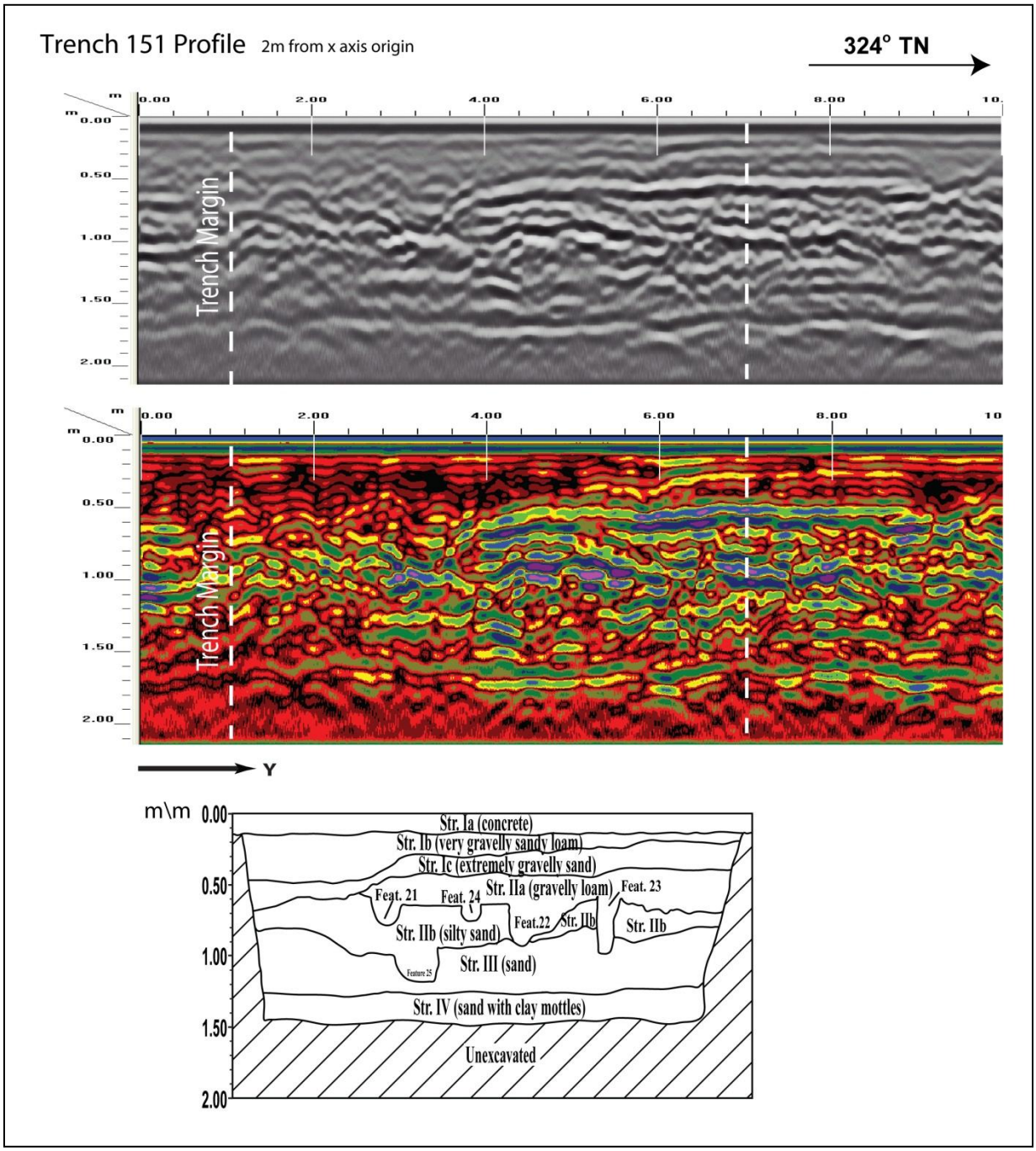

Figure 86. Visual comparison of excavated profile and GPR signal profile of T-151

Test Excavation 151A

T-151A measured 0.6 m by 6.0 m and was oriented northwest to southeast and was located within the sidewalk southeast of Halekauwila Street, 15.0 m northwest of Halekauwila Street and Cooke Street intersection. The GPR grid measured 1.5 m by 9.0 m with 0.25 m spacing between Y transects and 1.0 m spacing between X transects. Utilities located near the excavation include: electrical line 2.0 m southwest, water line 3.2 m southwest, water drain 3.2 m northeast. No utilities transected the excavation location.

A review of amplitude slice maps indicated no linear features which might indicate the presence of utilities. Reflectivity was relatively uniform throughout the grid and decreased with depth. A transition from higher reflectivity to lower reflectivity was observed at approximately 0.80 mbs (Figure 87).

GPR depth profiles for T-151A identified horizontal banding, commonly associated with stratigraphic layering, throughout the survey area (Figure 88). This banding corresponded to variations of density and chemical composition within fill deposits. The profile also indicated a change in reflectivity that occurred around 0.25 mbs and again at approximately 0.8 mbs. No utilities were observed in the profile. The maximum depth of clean signal return was approximately 1.1 mbs.

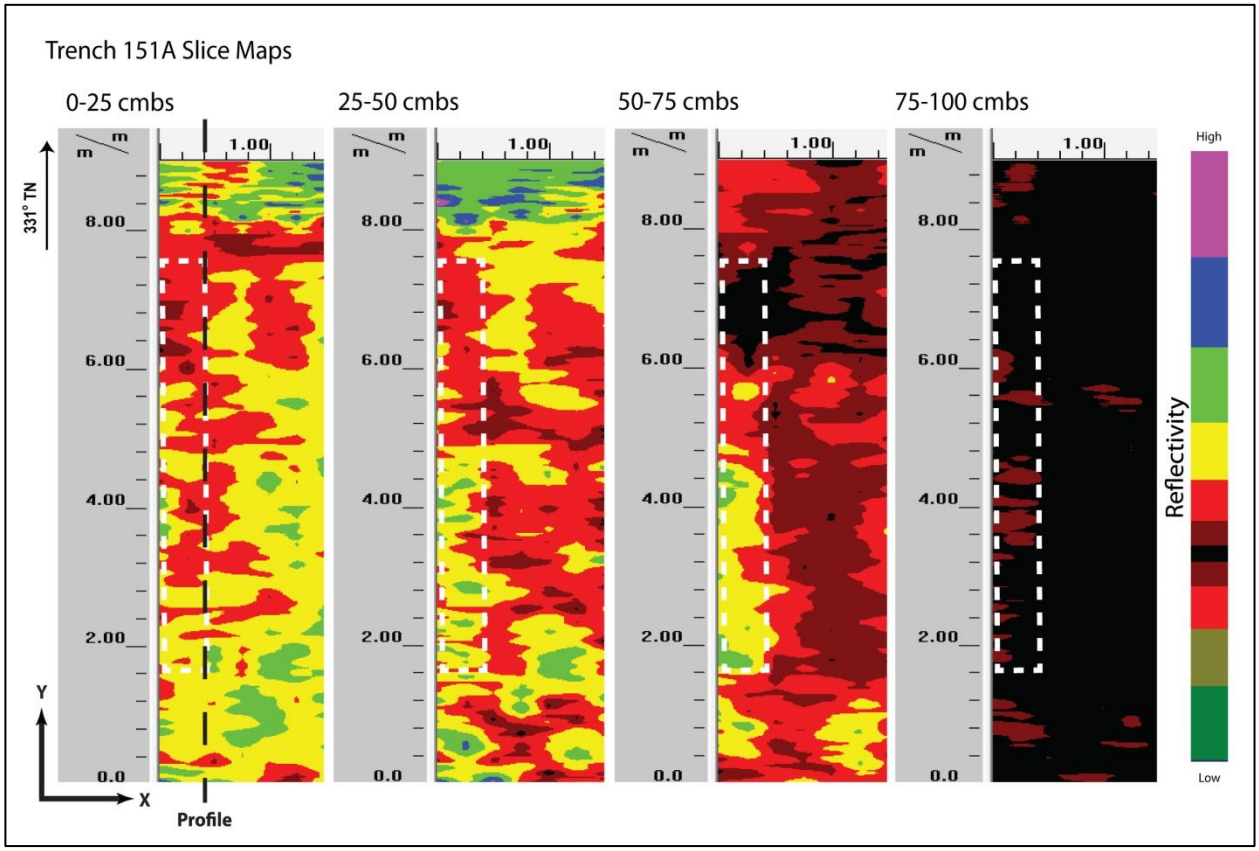

Figure 87. Slice maps of T-151A at 25cm depth intervals

A visual comparison of the excavated profile and the GPR signal profile showed a moderate correlation in stratigraphic transitions (Figure 88). Strata Ia to Id were all clearly observed and occured near the ground-truthed depths. Strata included: concrete, very gravelly sandy loam, very gravelly sand, gravelly silty sandy loam fill, silty sandy loam fill, silty loamy sand fill, and silty sandy loam fill. No discrete objects were observed in the GPR results or subsequent excavation.

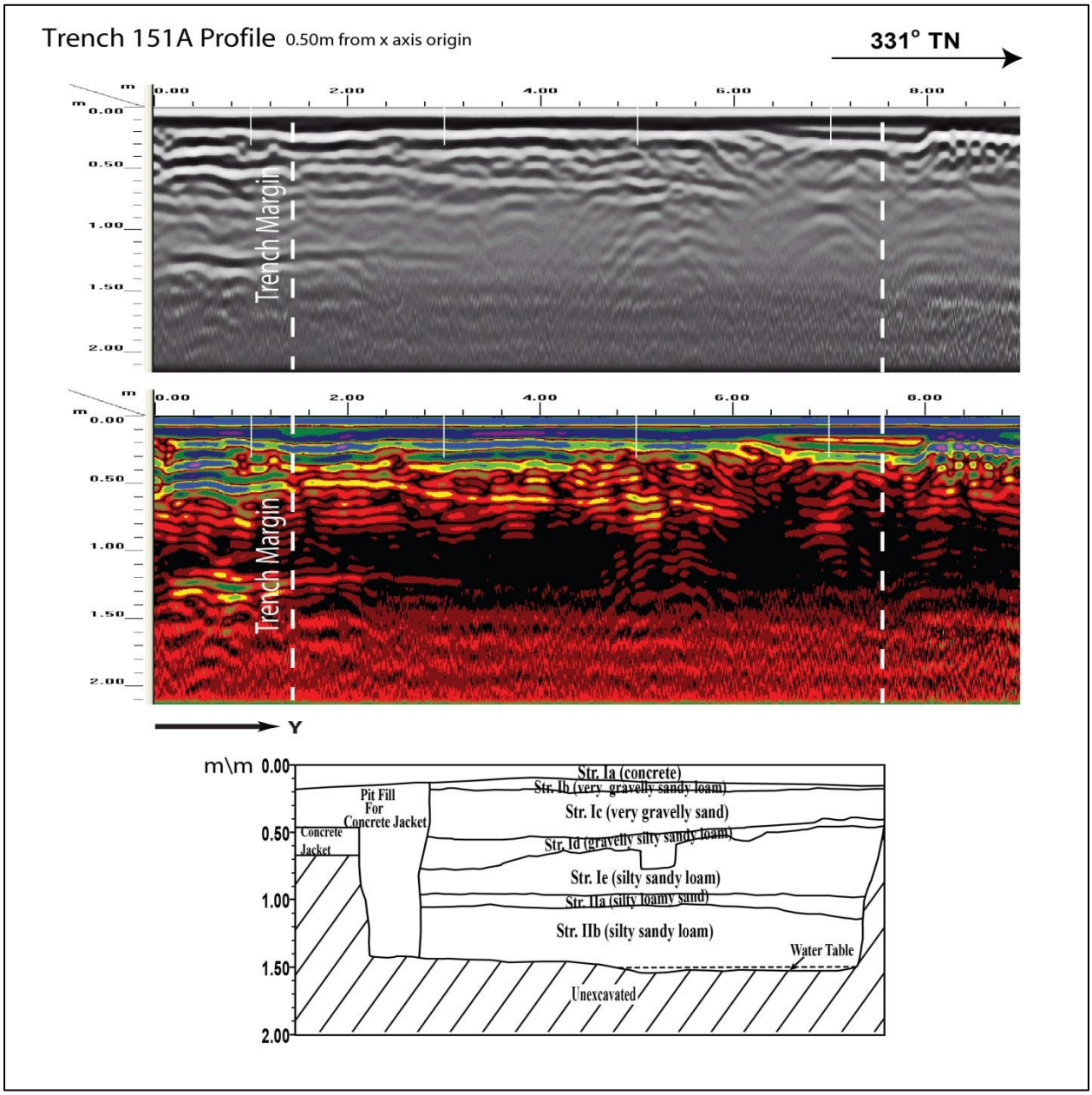

Figure 88. Visual comparison of excavated profile and GPR signal profile of T-151

Test Excavation 152

T-152 measures 0.6 m by 6.0 m and was oriented northwest to southeast and was located within the road cut of Halekauwila Street, 2.0 m northwest of Halekauwila Street and Koula Street intersection. The GPR grid measured 3.0 m by 10.0 m with 0.25 m spacing between Y transects and 1.0 m spacing between X transects. Utilities located near the excavation include: gas line 1.5 m northwest and 1.5 m east, sewer line 1.7 m northeast. No utilities transected the excavation location.

A review of amplitude slice maps indicated a linear feature but was not encountered during excavation. Reflectivity was relatively uniform throughout the grid and decreased with depth except for the linear feature. A transition from higher reflectivity to lower reflectivity was observed at approximately 0.5 mbs (Figure 89).

GPR depth profiles for T-152 identified horizontal banding, commonly associated with stratigraphic layering, throughout the survey area (Figure 90). This banding corresponded to variations of density and chemical composition within fill deposits. The profile also indicated a change in reflectivity that occurred around 0.15 mbs. No utilities were observed in the profile. The maximum depth of clean signal return was approximately 1.1 mbs.

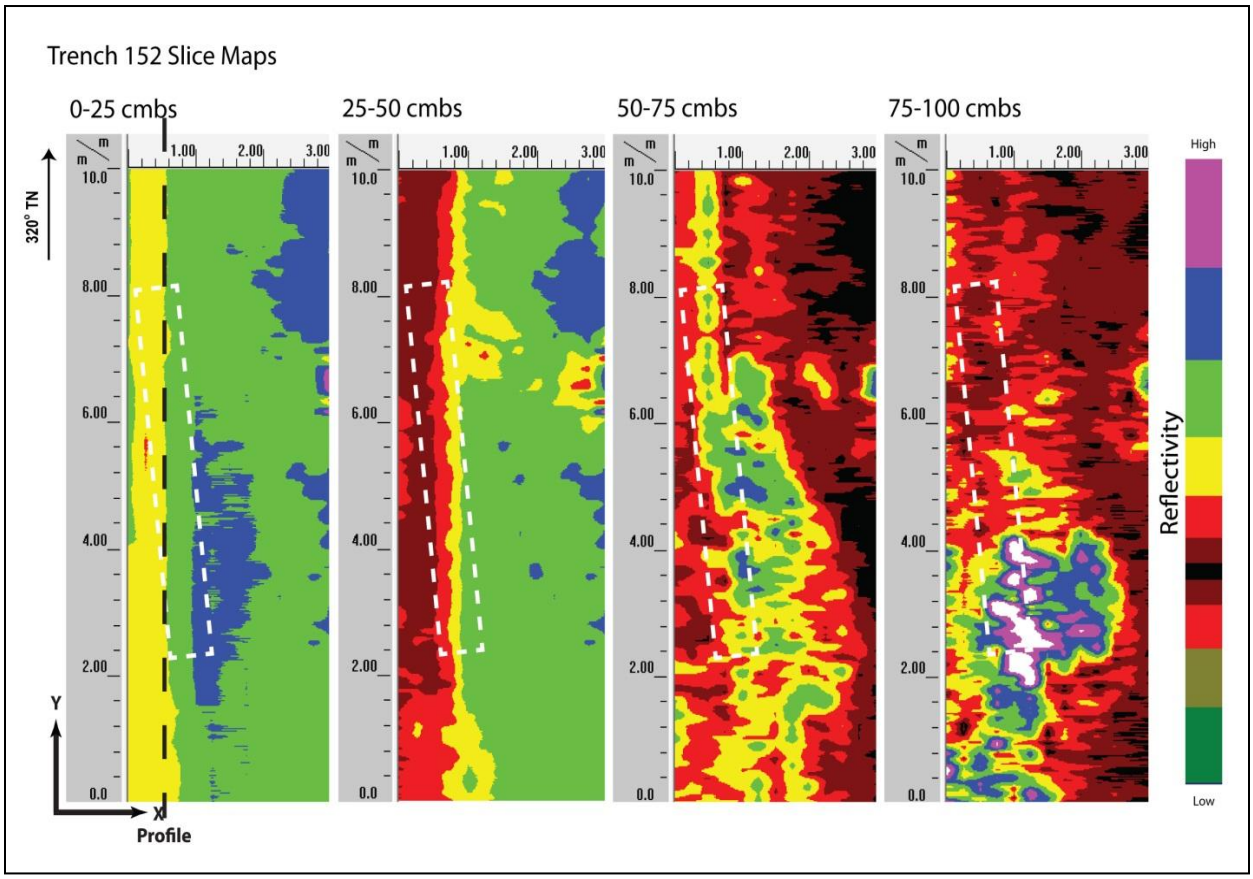

Figure 89. Slice maps of T-152 at 25cm depth intervals

A visual comparison of the excavated profile and the GPR signal profile showed a moderate correlation in stratigraphic transitions (Figure 90). Strata Ia to Ic were clearly observed and occured at the ground-truthed depths. Strata included: asphalt, very gravelly loam, extremely gravelly sand, silty clay loam fill, gravelly sandy loam fill, loamy sand fill, loamy sand fill, and natural sandy clay loam. No discrete objects or other stratigraphic transitions were observed in the GPR results or subsequent excavation.

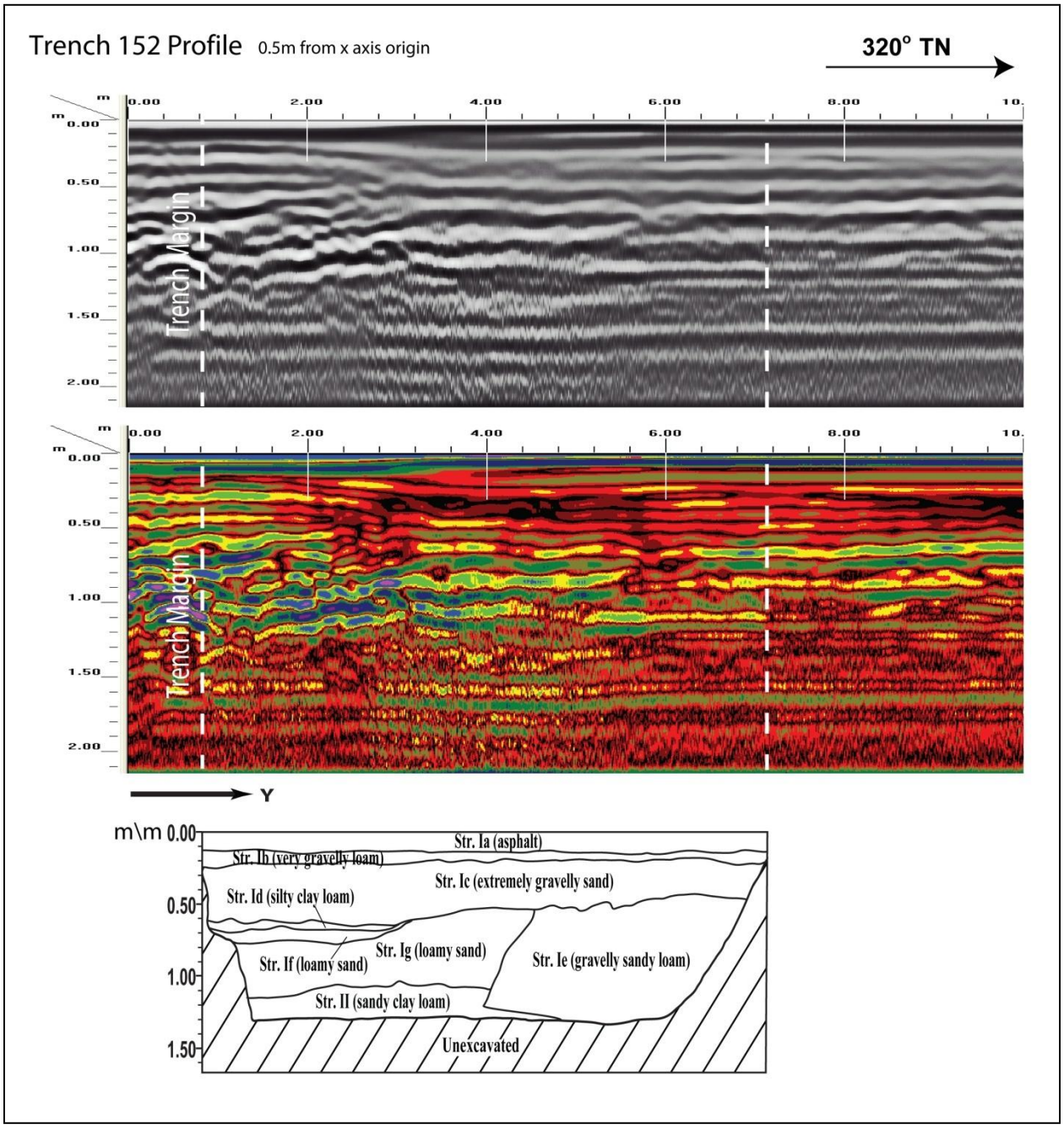

Figure 90. Visual comparison of excavated profile and GPR signal profile of T-152

Test Excavation 153

T-153 measured 0.6 m by 6.0 m and was oriented northwest to southeast, and was located within the road cut of Halekauwila Street, 18.0 m southeast of Halekauwila Street and Koula Street intersection. The GPR grid measured 2.5 m by 10.0 m with 0.25 m spacing between Y transects and 1.0 m spacing between X transects. Utilities located near the excavation include: gas line 1.7 m northeast, sewer line 2.5 m southeast and 2.6 m northeast. A metal utility pipe was encountered 0.68 mbs on the southeast end of the excavation and a concrete curb was observed within the side wall starting at 0.15 mbs.

A review of amplitude slice maps indicated a linear feature that corresponded to the concrete curb observed within the side wall of the excavation. Reflectivity was relatively uniform throughout the grid and decreased with depth. A transition from higher reflectivity to lower reflectivity was observed at approximately 0.5 mbs (Figure 91).

GPR depth profiles for T-153 identified horizontal banding, commonly associated with stratigraphic layering, throughout the survey area (Figure 92). This banding corresponded to variations of density and chemical composition within fill deposits. The profile also indicated a change in reflectivity that occurred around 0.35 mbs. An anomaly was observed in the profile and could corresponded to the metal utility pipe encountered during excavation. The maximum depth of clean signal return was approximately 1.0 mbs.

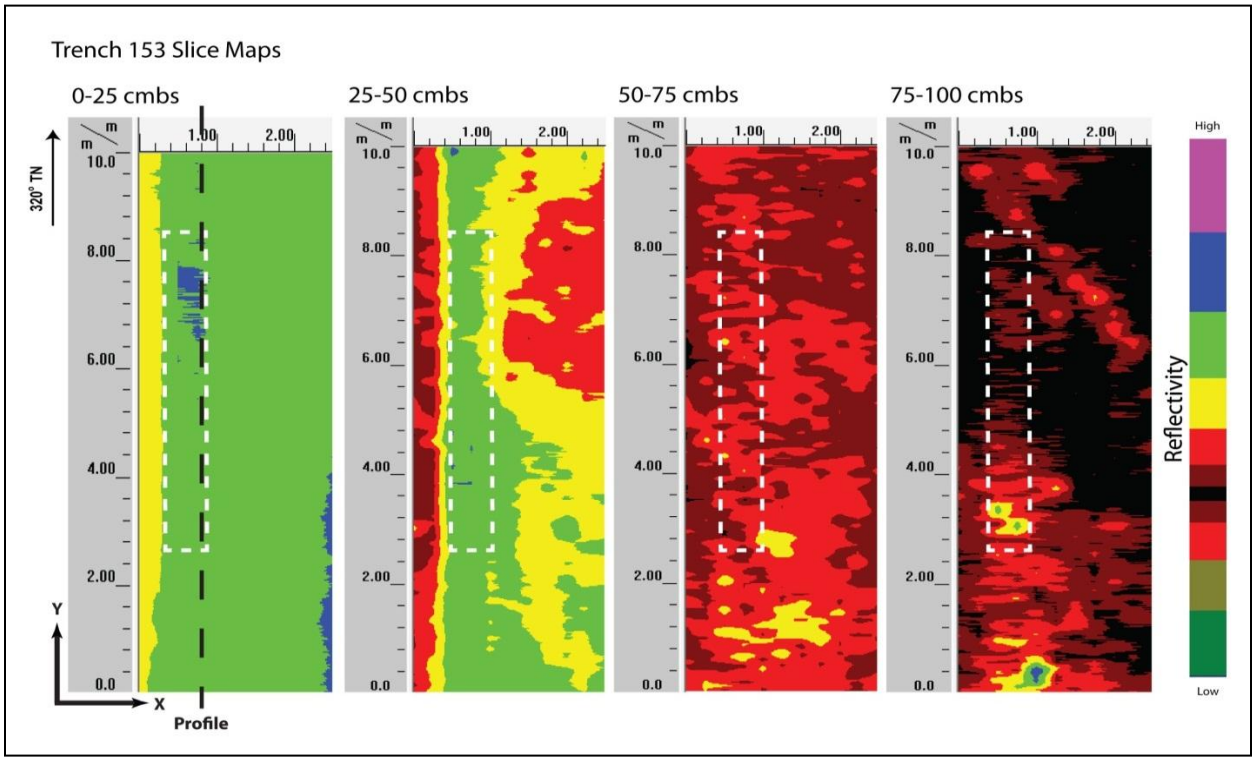

Figure 91. Slice maps of T-153 at 25cm depth intervals

A visual comparison of the excavated profile and the GPR signal profile showed a strong correlation in stratigraphic transitions (Figure 92). Strata Ia to Ic were clearly observed and occured at the ground-truthed depths. A metal utility pipe was found 0.68 mbs. An anomaly was observed in the profile at this location and seems to corresponded to the pipe. All other sediment transitions were below the maximum clean signal return depth. No other discrete objects were observed in the GPR results or subsequent excavation.

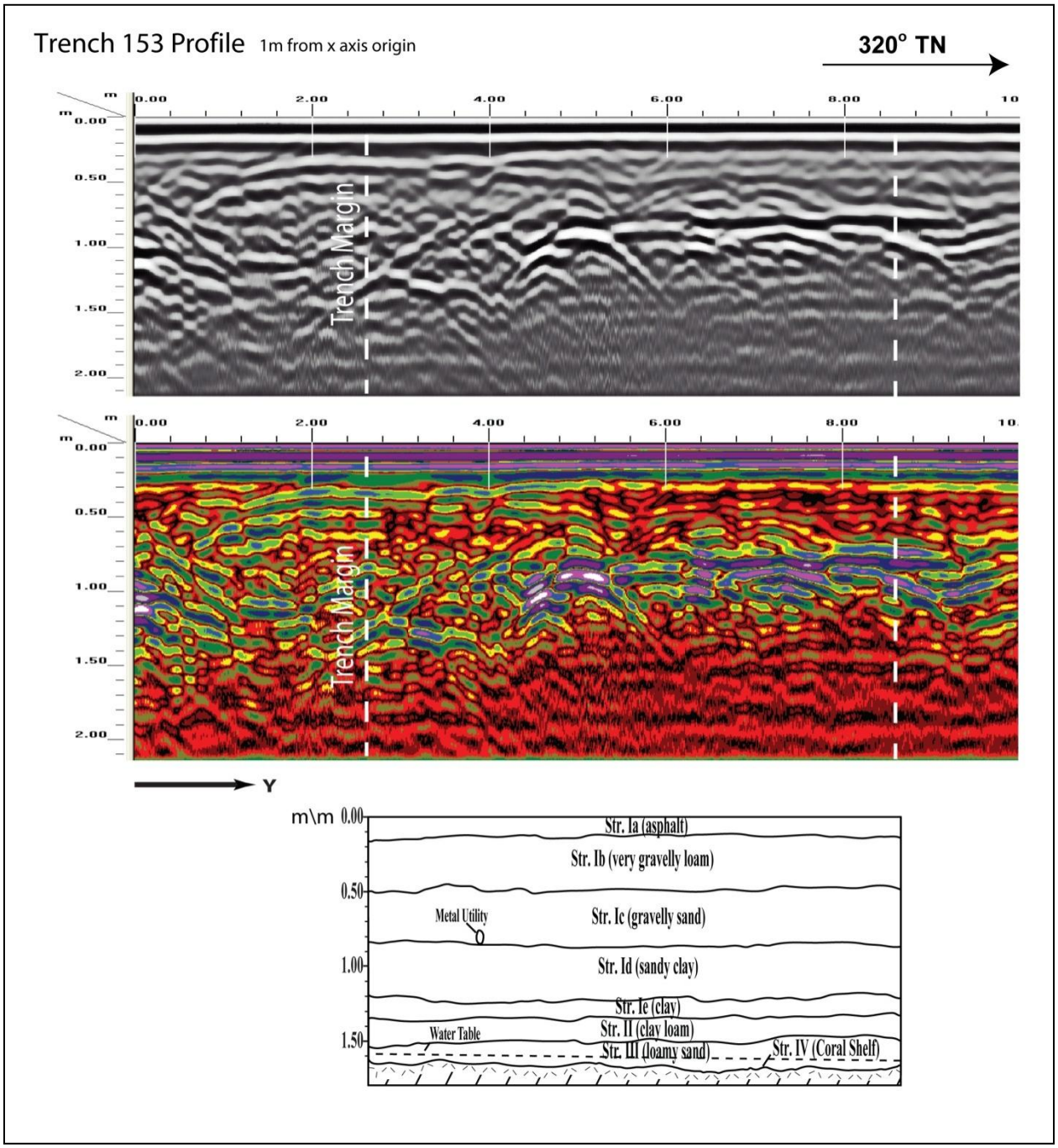

Figure 92. Visual comparison of excavated profile and GPR signal profile of T-153

Test Excavation 154

T-154 measured 0.6 m by 6.0 m and was oriented northwest to southeast and was located within the road cut of Halekauwila Street, 25.0 m northwest of Halekauwila Street and Ahui Street intersection. The GPR grid measured 2.5 m by 9.0 m with 0.25 m spacing between Y transects and 1.0 m spacing between X transects. Utilities located near the excavation include: sewer line 2.6 m northeast and 4.1 m northeast. No utilities transected the excavation location.

A review of amplitude slice maps indicated no linear features which might indicate the presence of utilities. Reflectivity was relatively uniform throughout the grid and decreased with depth. A transition from higher reflectivity to lower reflectivity was observed at approximately 0.75 mbs (Figure 93).

GPR depth profiles for T-154 identified horizontal banding, commonly associated with stratigraphic layering, throughout the survey area (Figure 94). This banding corresponded to variations of density and chemical composition within fill deposits. The profile also indicated a change in reflectivity that occurred around 0.3 mbs. No utilities were observed in the profile. The maximum depth of clean signal return was approximately 1.5 mbs.

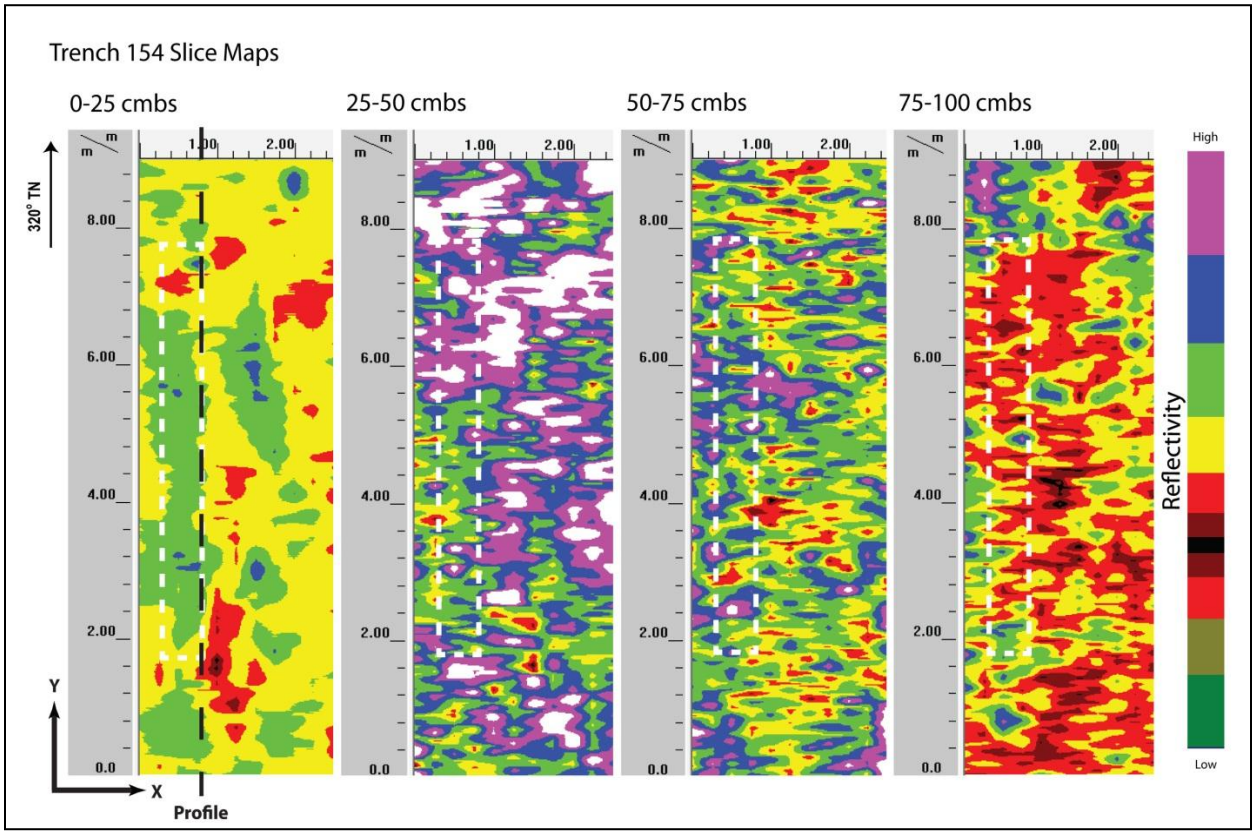

Figure 93. Slice maps of T-154 at 25cm depth intervals

A visual comparison of the excavated profile and the GPR signal profile showed a moderate correlation in stratigraphic transitions (Figure 94). Strata Ia to Id were all clearly observed and occured at the ground-truthed depths. Strata Ia through Ic may be difficult to individually discern, possibly due to the fact that they were very thin layers of compacted fill, but based on reflectivity and horizontal banding it was apparent that there were multiple layers of fill events. Textural changes in the form of multiple small hyprbolas were apparent in Stratum Id which was gravelly sand fill. No discrete objects or other stratigraphic transitions were observed in the GPR results or subsequent excavation.

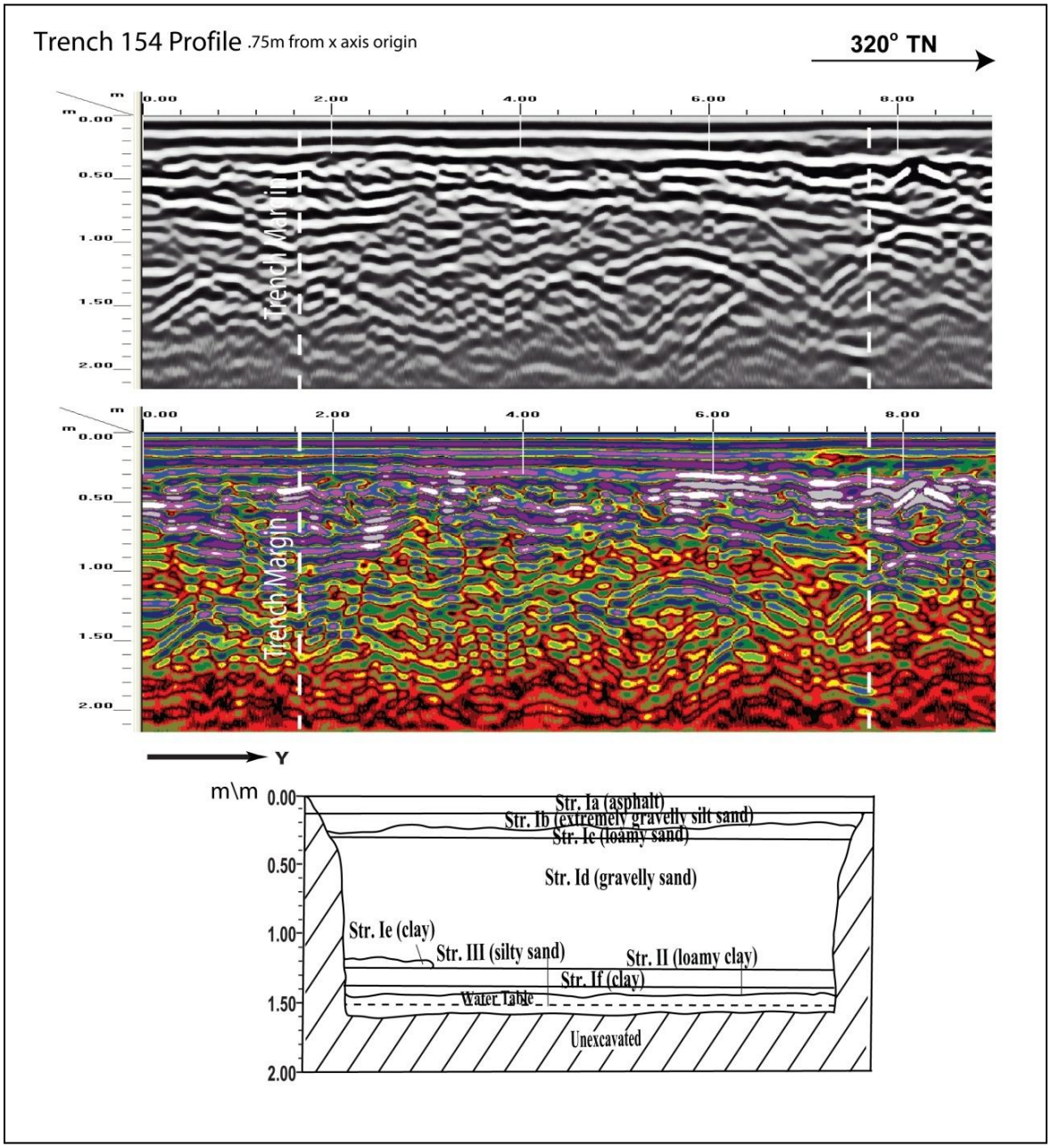

Figure 94. Visual comparison of excavated profile and GPR signal profile of T-154

Test Excavation 155

T-155 measured 0.6 m by 6.0 m and was oriented northwest to southeast and was located within the road cut of Halekauwila Street, 35.0 m southeast of Halekauwila Street and Ahui Street intersection. The GPR grid measured 3.0 m by 10.0 m with 0.25 m spacing between Y transects and 1.0 m spacing between X transects. Utilities located near the excavation included: gas line 3.3 m northeast, sewer line 4.2 m northeast. No utilities transected the excavation location.

A review of amplitude slice maps indicated no linear features which might indicate the presence of utilities. Reflectivity was relatively uniform throughout the grid. A transition from higher reflectivity to lower reflectivity was observed at approximately 0.25 mbs and increases again around 0.75 mbs (Figure 95).

GPR depth profiles for T-155 identified horizontal banding, commonly associated with stratigraphic layering, throughout the survey area (Figure 96). This banding corresponded to variations of density and chemical composition within fill deposits. The profile also indicated a change in reflectivity that occurred around 0.3 mbs and again at 0.6 mbs. An anomaly was observed in the profile but was not encountered during excavation. The maximum depth of clean signal return was approximately 1.25 mbs.

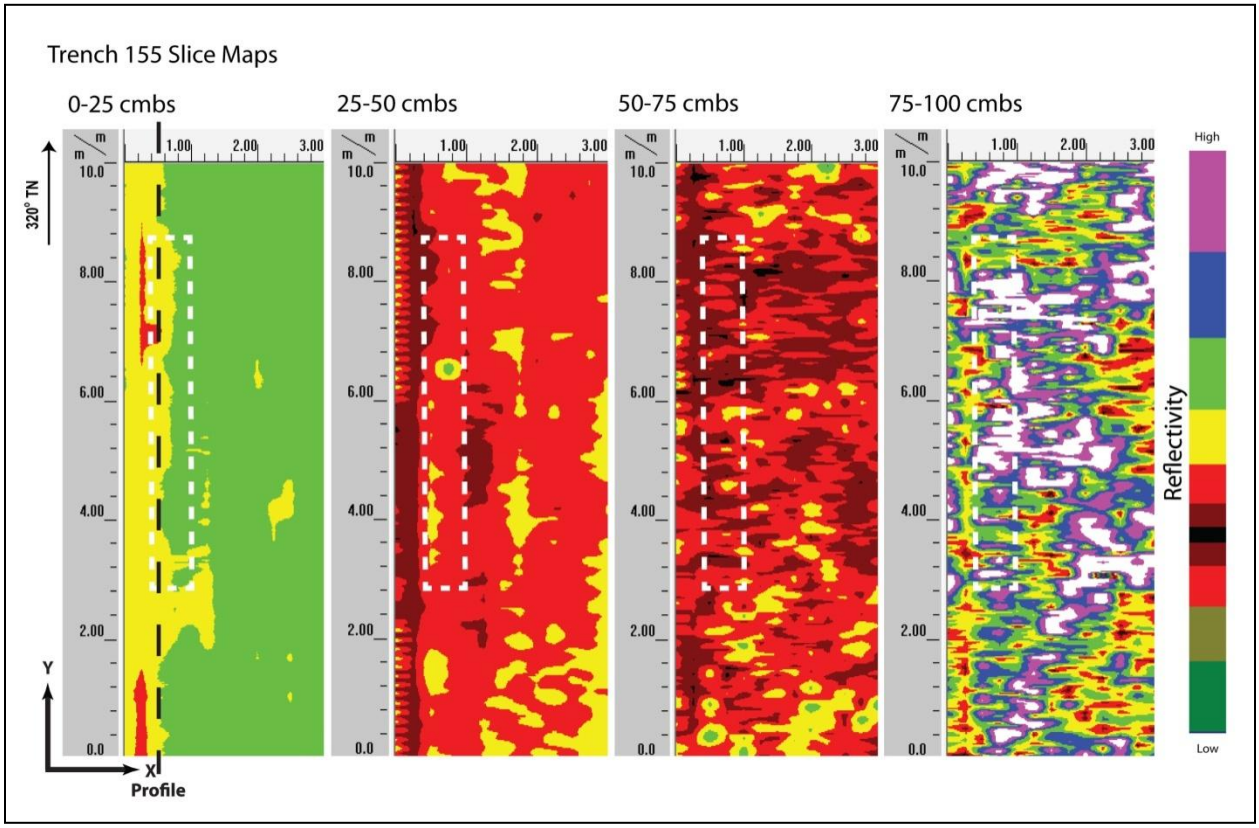

Figure 95. Slice maps of T-155 at 25cm depth intervals

A visual comparison of the excavated profile and the GPR signal profile showed a moderate correlation in stratigraphic transitions (Figure 96). Strata Ia to Ib were all clearly observed and occured near the ground-truthed depths. Strata included: asphalt, extremely gravelly sand fill, clay fill, clay fill, natural clay, and natural gravelly sandy clay. No discrete objects or other stratigraphic transitions were observed in the GPR results or subsequent excavation.

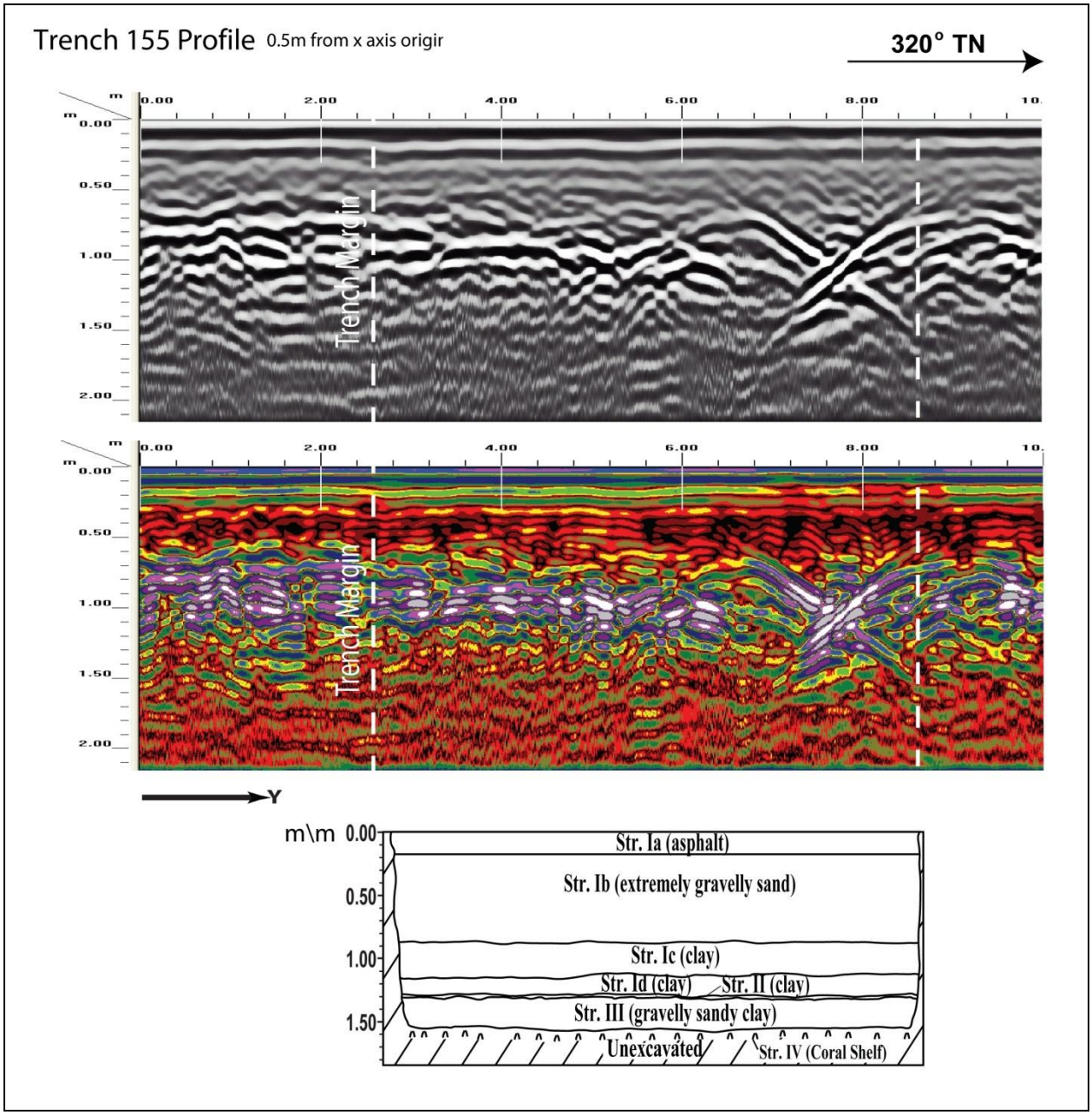

Figure 96. Visual comparison of excavated profile and GPR signal profile of T-155

Test Excavation 156

T-156 measured 0.6 m by 6.0 m and was oriented northwest to southeast and was located within the road cut of Halekauwila Street, 7.0 m northwest of Halekauwila Street and Kamani Street intersection. The GPR grid measured 3.0 m by 10.0 m with 0.25 m spacing between Y transects and 1.0 m spacing between X transects. Utilities located near the excavation include: water drain 1.8 m northeast, gas line 2.5 m northeast, sewer line 3.8 m northeast. A concrete jacket was encountered 0.51 mbs in the center of the excavtion.

A review of amplitude slice maps indicated a linear feature which corresponded to the concrete jacket that was encountered during excavation. Reflectivity was relatively uniform throughout the grid and decreased with depth. A transition from higher reflectivity to lower reflectivity was observed at approximately 0.5 mbs (Figure 97).

GPR depth profiles for T-156 identified horizontal banding, commonly associated with stratigraphic layering, throughout the survey area (Figure 98). This banding corresponded to variations of density and chemical composition within fill deposits. The profile also indicated a change in reflectivity that occurred around 0.2 mbs and again at approximately 0.65 mbs. An anomaly was observed in the profile and corresponded with the concrete jacket encountered during excavation. The maximum depth of clean signal return was approximately 1.5 mbs.

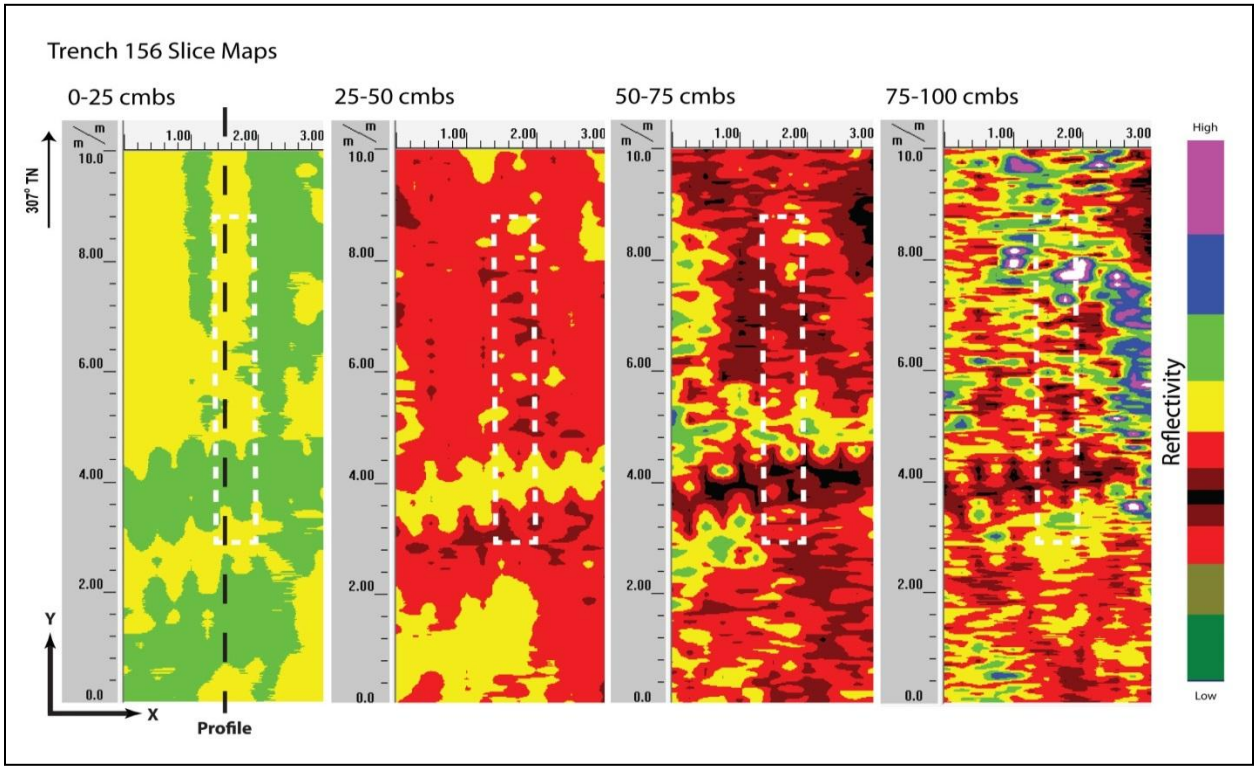

Figure 97. Slice maps of T-156 at 25cm depth intervals

A visual comparison of the excavated profile and the GPR signal profile showed a moderate correlation in stratigraphic transitions (Figure 98). Strata Ia to Ic were all clearly observed and occured near the ground-truthed depths. A concrete jacket was found 0.51 mbs. This corresponded to an anomaly at this location on the profile map. No other discrete objects were observed in the GPR results or subsequent excavation.

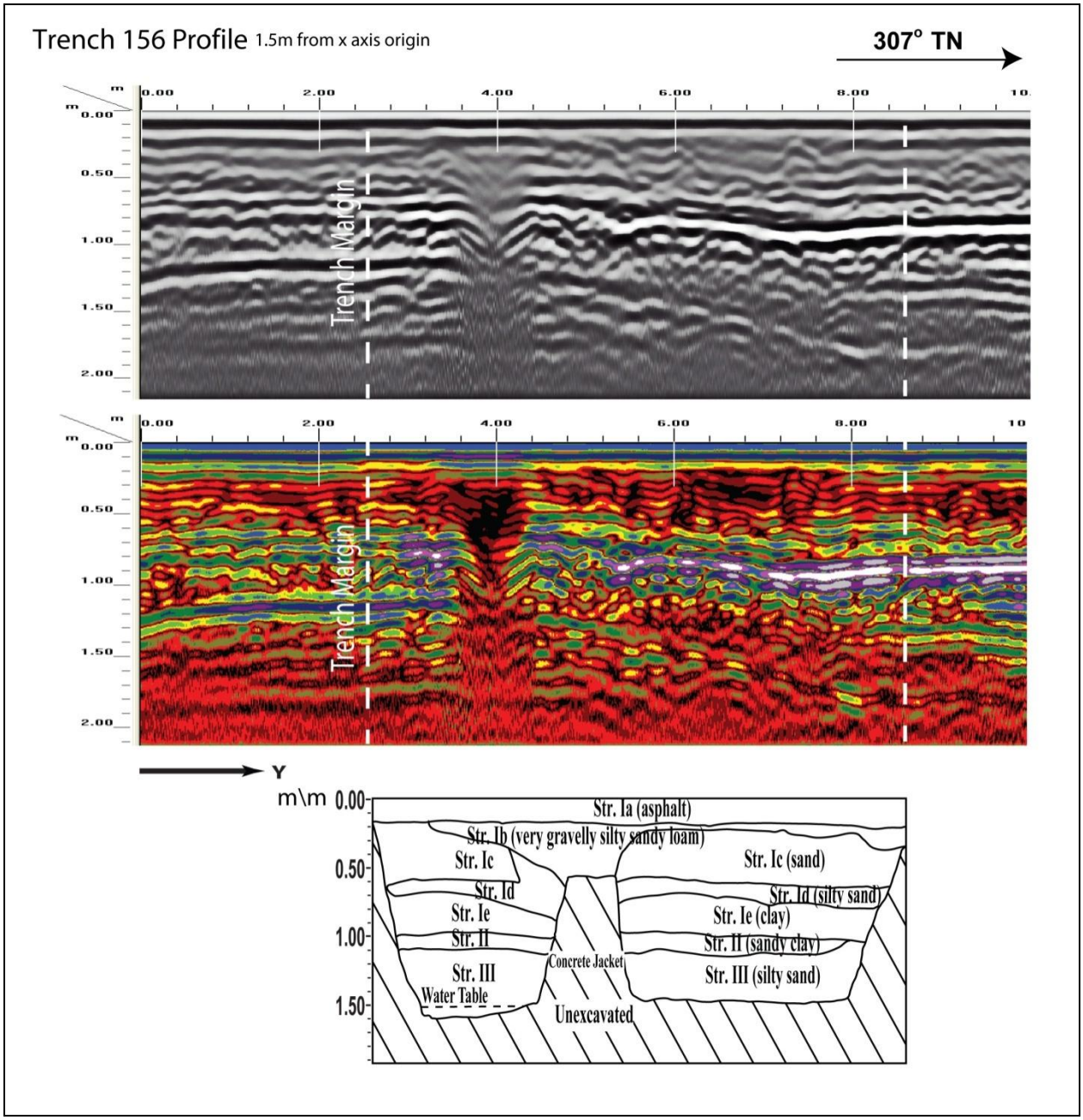

Figure 98. Visual comparison of excavated profile and GPR signal profile of T-156

Test Excavation 157

T-157 measured 0.9 m by 3.0 m and was oriented northwest to southeast and was located within the road cut of Halekauwila Street, 15.0 m southeast of Halekauwila Street and Kamani Street intersection. The GPR grid measured 3.0 m by 10.0 m with 0.25 m spacing between Y transects and 1.0 m spacing between X transects. Utilities located near the excavation include: water drain 1.7 m northeast, sewer line 1.8 m southeast. No utilities transected the excavation location.

A review of amplitude slice maps indicated no linear features which might indicate the presence of utilities. Reflectivity was relatively uniform throughout the grid and decreased with depth. A transition from higher reflectivity to lower reflectivity was observed at approximately 0.75 mbs (Figure 99).

GPR depth profiles for T-157 identified horizontal banding, commonly associated with stratigraphic layering, throughout the survey area (Figure 100). This banding corresponded to variations of density and chemical composition within fill deposits. The profile also indicated a change in reflectivity that occurred around 0.25 mbs. No utilities or anomalies were observed in the profile. The maximum depth of clean signal return was approximately 1.5 mbs.

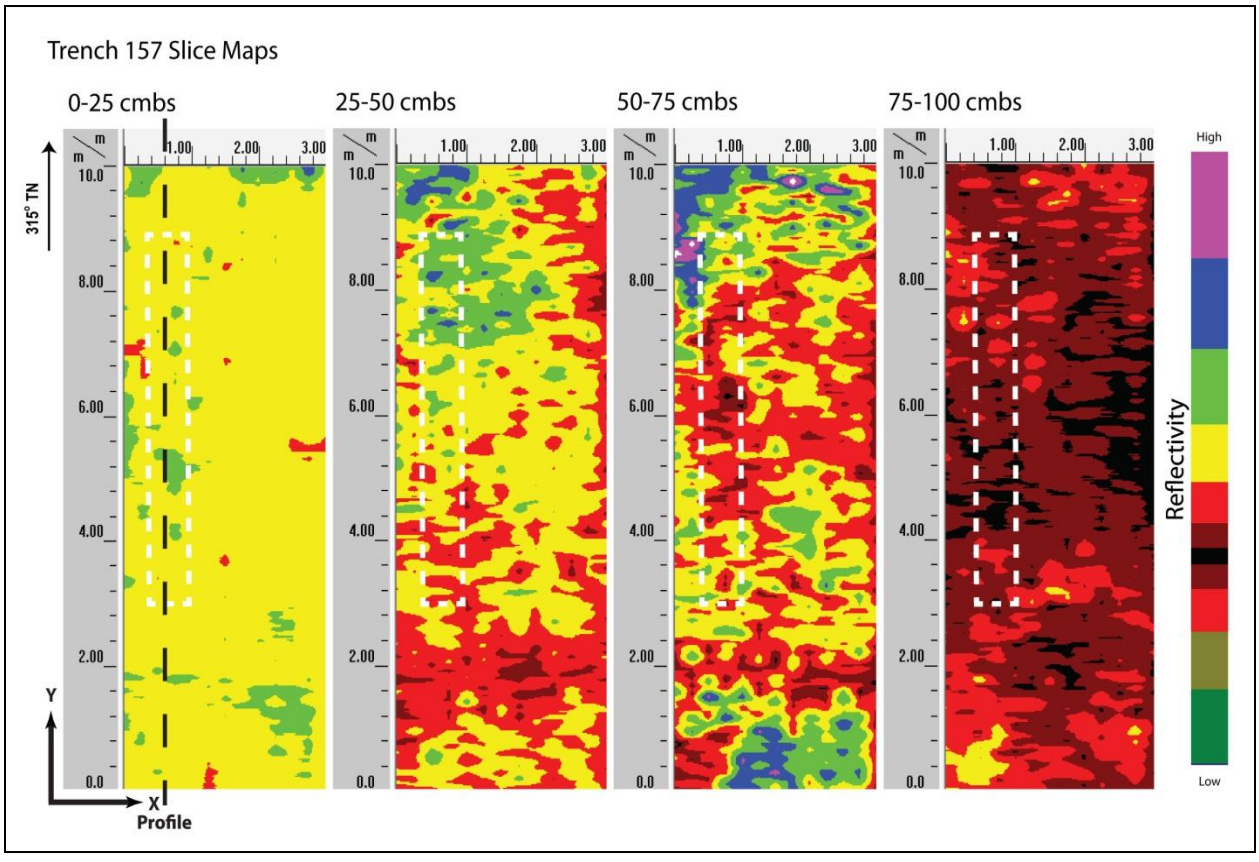

Figure 99. Slice maps of T-157 at 25cm depth intervals

A visual comparison of the excavated profile and the GPR signal profile showed a weak correlation in stratigraphic transitions (Figure 100). Strata included: asphalt, extremely cobbly sand fill, sand fill, cobbly sand, fill, silty clay fill, natural sand, and natural loamy sand. These transitions were not clearly depicted in the GPR profile at the depths that they occured. No other sediment transitions or discrete objects were observed in the GPR results or subsequent excavation.

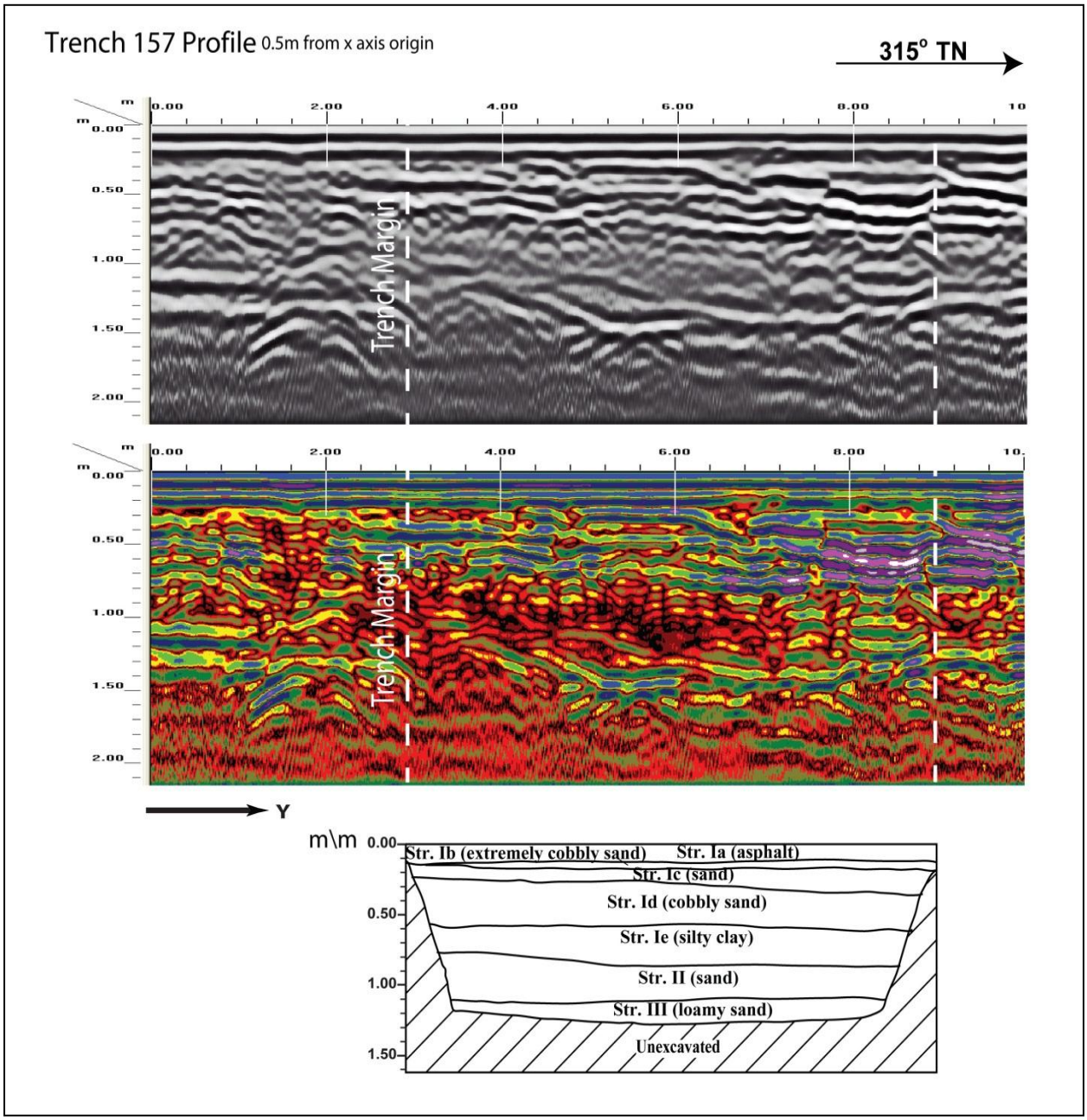

Figure 100. Visual comparison of excavated profile and GPR signal profile of T-157

Test Excavation 158

T-158 measured 0.9 m by 3.0 m and was oriented northwest to southeast and was located within the road cut of Halekauwila Street, 18.0 m southeast of Halekauwila Street and Kamani Street intersection. The GPR grid measured 3.0 m by 8.0 m with 0.25 m spacing between Y transects and 1.0 m spacing between X transects. Utilities located near the excavation include: water drain 1.6 m northeast. No utilities transected the excavation location.

A review of amplitude slice maps indicated a linear feature but it was not encountered during excavation. Reflectivity was relatively uniform throughout the grid and decreased with depth except for the linear feature. A transition from higher reflectivity to lower reflectivity was observed at approximately 0.25 mbs and increases again around 0.75 mbs (Figure 101).

GPR depth profiles for T-158 identified horizontal banding, commonly associated with stratigraphic layering, throughout the survey area (Figure 102). This banding corresponded to variations of density and chemical composition within fill deposits. The profile also indicated a change in reflectivity that occurred around 0.2 mbs. An anomaly was observed in the profile but was not encountered during excavation. The maximum depth of clean signal return was approximately 1.3 mbs.

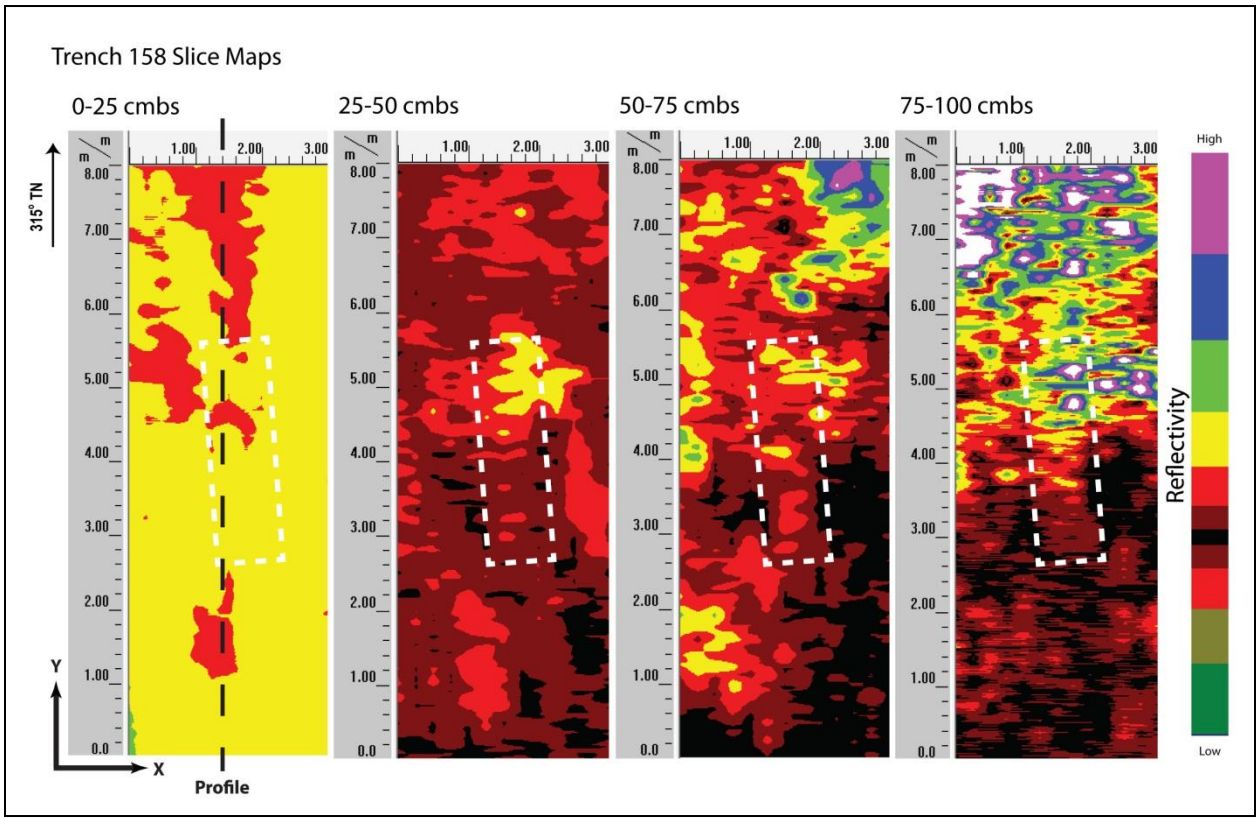

Figure 101. Slice maps of T-158 at 25cm depth intervals

A visual comparison of the excavated profile and the GPR signal profile showed a weak correlation in stratigraphic transitions (Figure 102). Strata included: asphalt, very gravelly to cobbly sand fill, clay fill, loamy sand fill, and sand fill. These transitions were not clearly depicted in the GPR profile at the depths that they occurred. No other sediment transitions or discrete objects were observed in the GPR results or subsequent excavation.

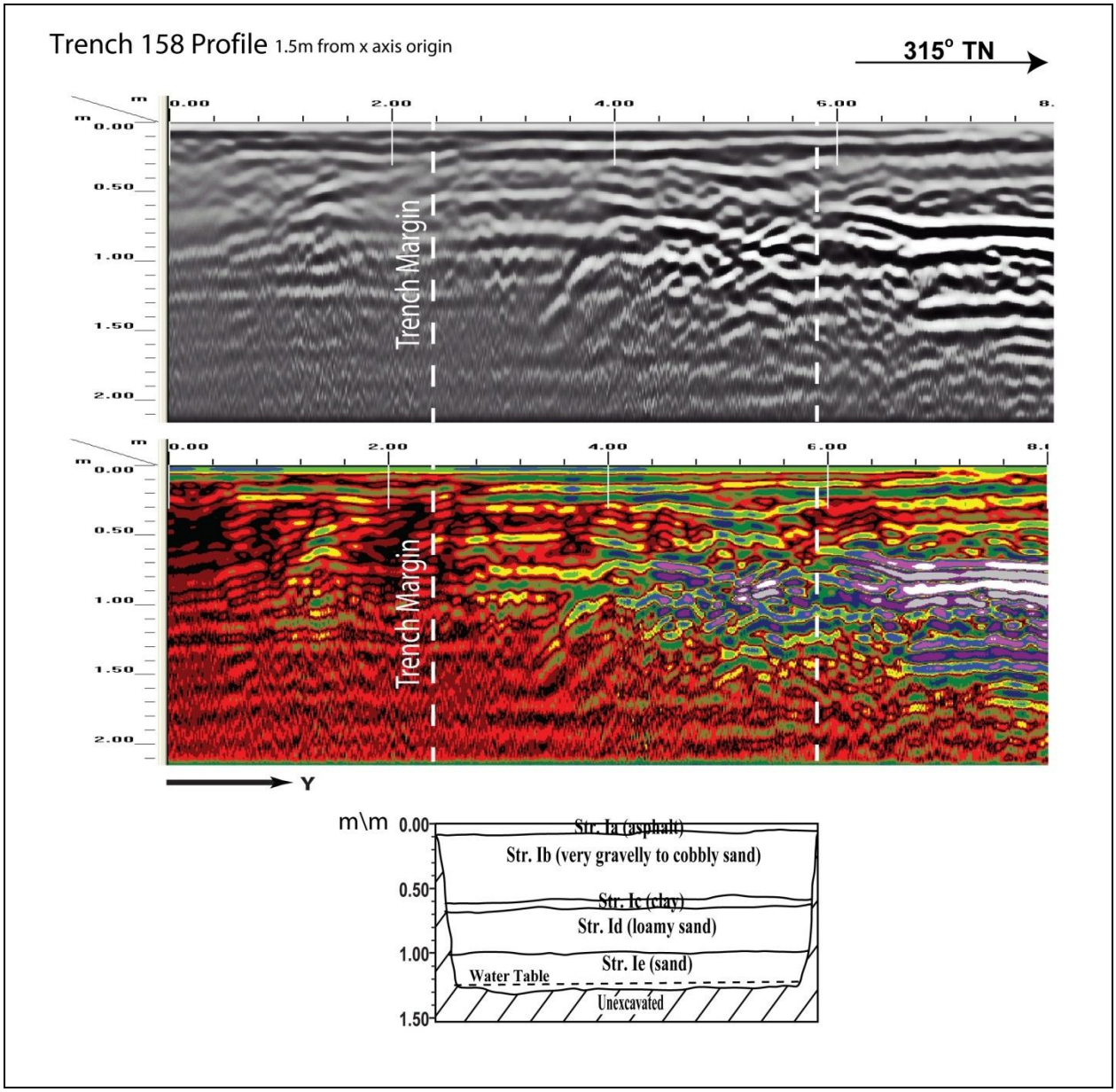

Figure 102. Visual comparison of excavated profile and GPR signal profile of T-158

Test Excavation 159

T-159 measured 0.9 m by 3.0 m and was oriented northwest to southeast and was located within Kanpai’s parking lot, 29.0 m southeast of Halekauwila Street and Kamani Street intersection. The GPR grid measured 2.5 m by 7.0 m with 0.25 m spacing between Y transects and 1.0 m spacing between X transects. Utilities located near the excavation include: electrical line 3.6 m southwest, water line 5.5 m southwest. A concrete slab was encountered 0.6 mbs and extended over the majority of the northwestern end of the excavation.

A review of amplitude slice maps indicated a linear feature on the northwest end of the excavation that corresponded to a concrete slab discovered during excavation. Reflectivity was relatively uniform throughout the grid and decreased with depth except for the concrete slab. A transition from higher reflectivity to lower reflectivity was observed at approximately 0.25 mbs (Figure 103).

GPR depth profiles for T-159 identified horizontal banding, commonly associated with stratigraphic layering, throughout the survey area (Figure 104). This banding corresponded to variations of density and chemical composition within fill deposits. The profile also indicated a change in reflectivity that occurred around 0.25 mbs. An anomaly was observed in the profile and corresponded to the concrete slab encountered during excavation. The maximum depth of clean signal return was approximately 1.4 mbs.

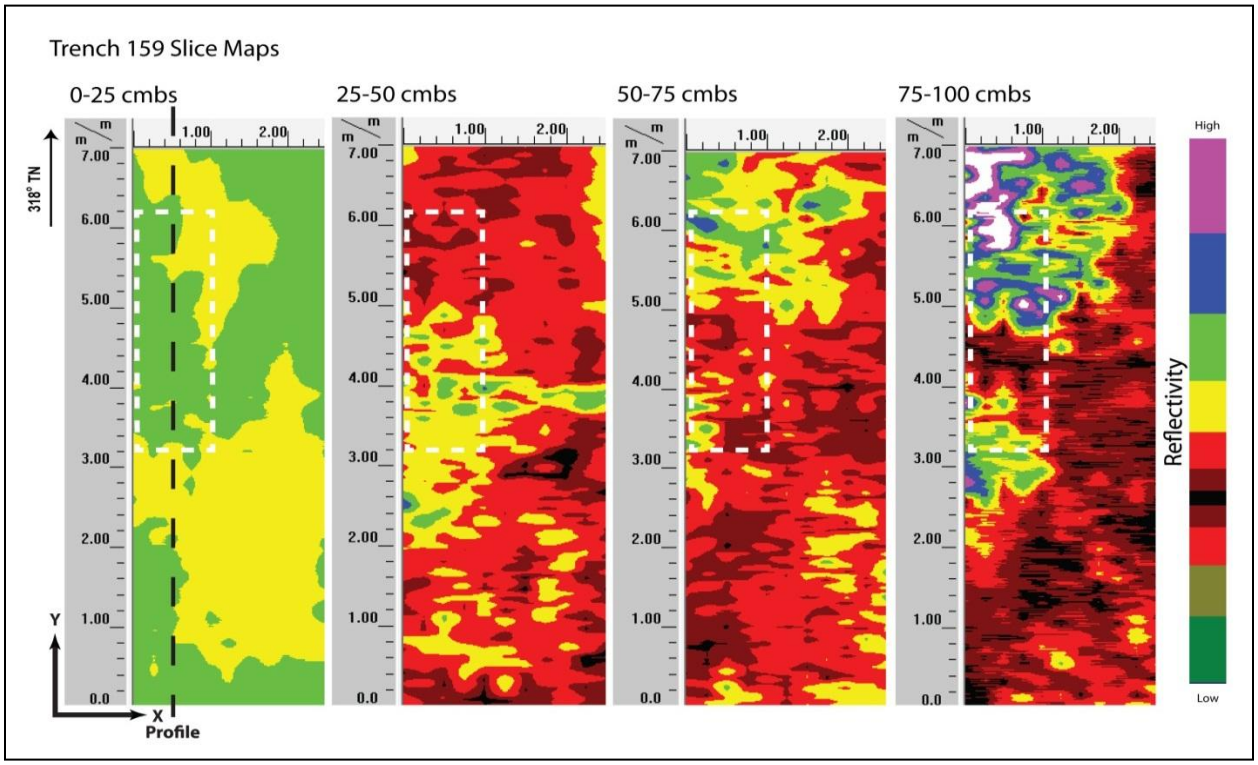

Figure 103. Slice maps of T-159 at 25cm depth intervals

A visual comparison of the excavated profile and the GPR signal profile showed a weak correlation in stratigraphic transitions (Figure 104). Strata included: asphalt, gravelly sandy loam fill, gravelly sandy loam fill, gravelly sand fill, silty clay fill, natural loamy sand, natural loamy sand, and natural sandy clay. These transitions were not clearly depicted in the GPR profile at the depths that they occured. A concrete slab was found 0.06 mbs. This corresponded with an anomaly that was observed at the same location on the profile map. No other discrete objects or stratigraphic transitions were observed in the GPR results or subsequent excavation.

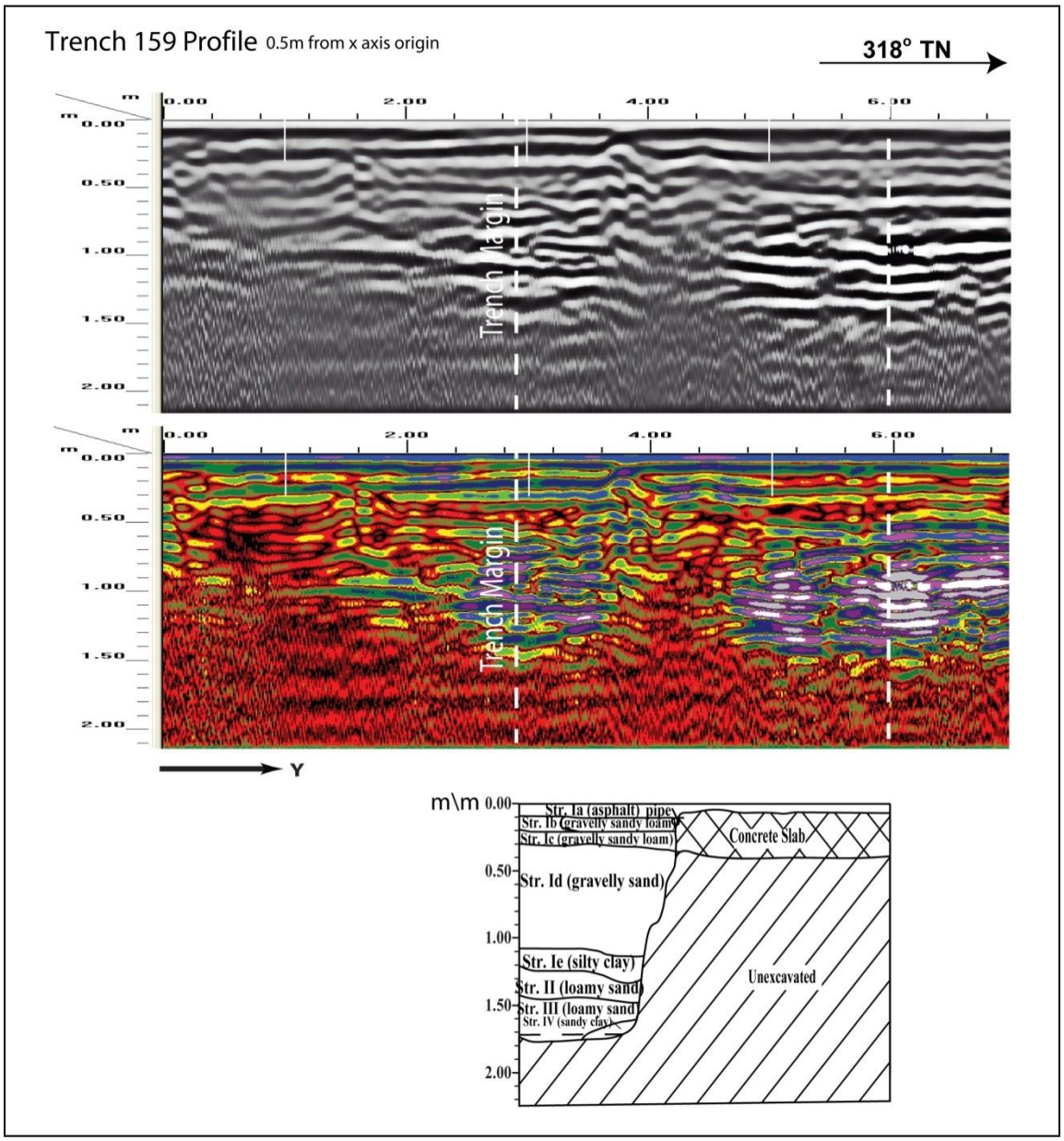

Figure 104. Visual comparison of excavated profile and GPR signal profile of T-159

Test Excavation 160

T-160 measured 0.9 m by 3.0 m and was oriented northeast to southwest and located within Kanpai’s parking lot, 30.0 m northwest of Halekauwila Street and Ward Avenue intersection. The GPR grid measured 3.0 m by 8.0 m with 0.25 m spacing between Y transects and 1.0 m spacing between X transects. Utilities located near the excavation include: telephone line 0.8 m southwest, electrical line 1.5 m southwest. No utilities transected the excavation location.

A review of amplitude slice maps indicated no linear features which might indicate the presence of utilities. Reflectivity was relatively uniform throughout the grid. A transition from higher reflectivity to lower reflectivity was observed at approximately 0.25 mbs and increases again around 0.75 mbs (Figure 105).

GPR depth profiles for T-160 identified horizontal banding, commonly associated with stratigraphic layering, throughout the survey area (Figure 106). This banding corresponded to variations of density and chemical composition within fill deposits. The profile also indicated a change in reflectivity that occurred around 0.15 mbs and again around 0.5 mbs. No utilities were observed in the profile. The maximum depth of clean signal return was approximately 1.5 mbs.

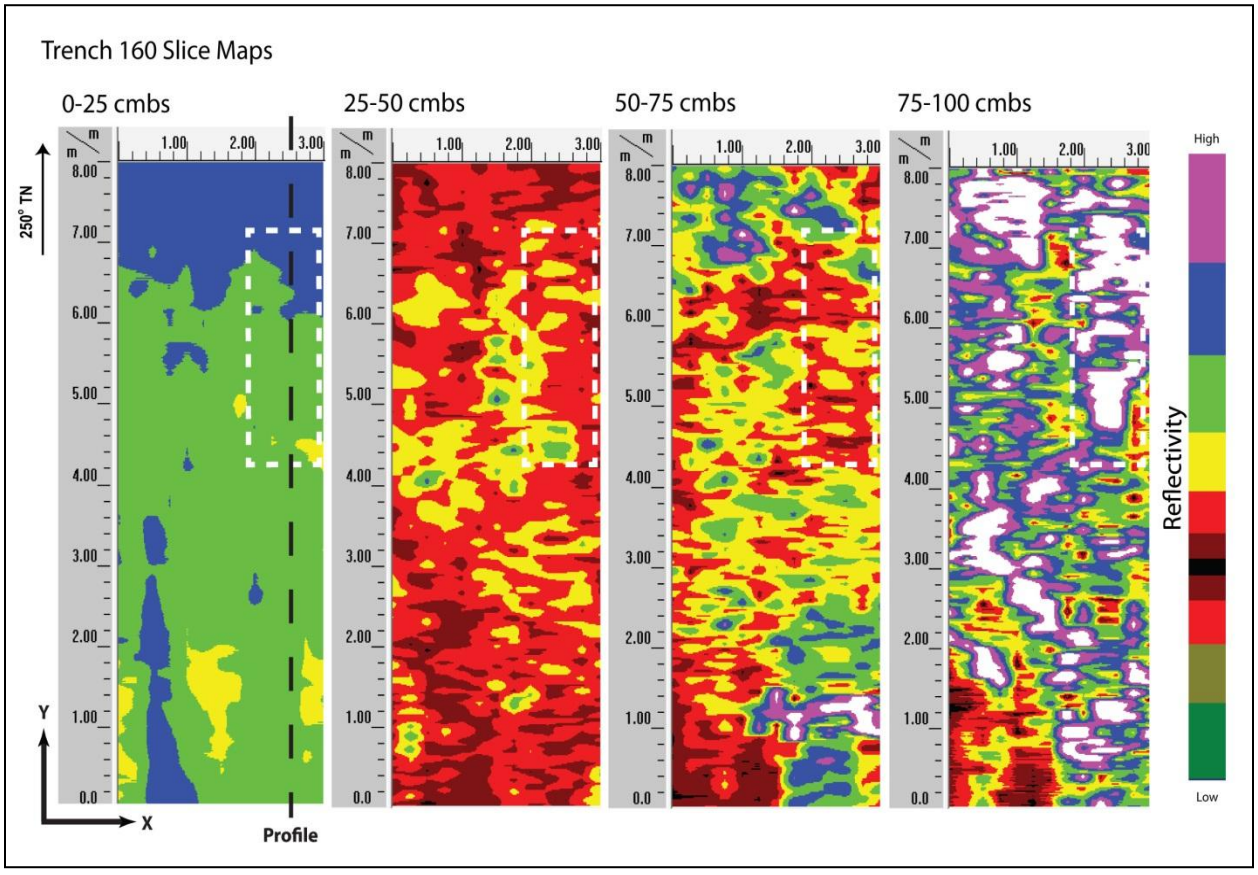

Figure 105. Slice maps of T-160 at 25cm depth intervals

A visual comparison of the excavated profile and the GPR signal profile showed a moderate correlation in stratigraphic transitions (Figure 106). Strata Ia to Ie were all clearly observed and occured near the ground-truthed depths. Strata included: asphalt, sandy clay loam fill, very gravelly loamy sand fill, sandy clay fill, sandy clay loam fill, sand fill, and natural sandy clay. No discrete objects or other stratigraphic transitions were observed in the GPR results or subsequent excavation.

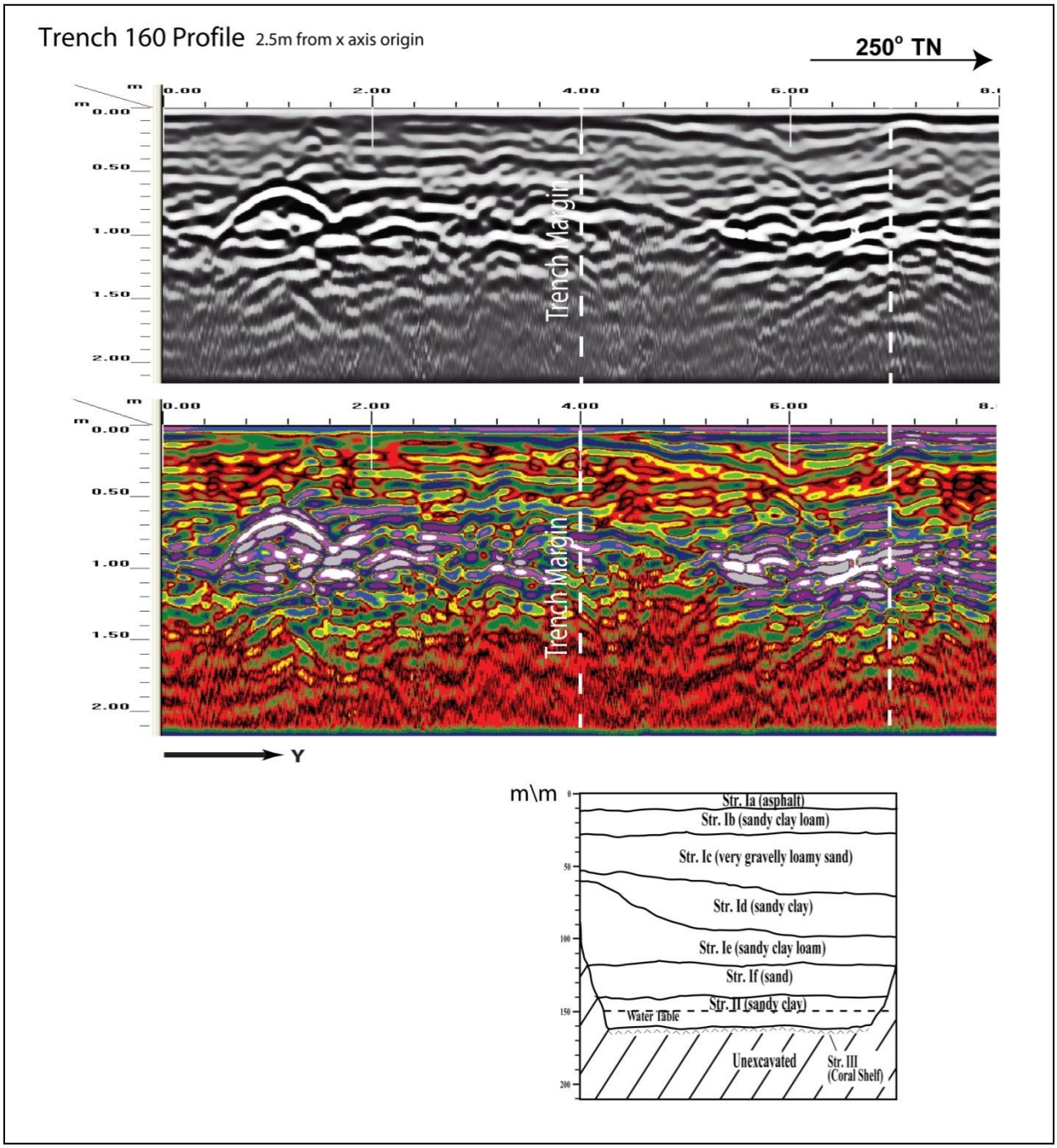

Figure 106. Visual comparison of excavated profile and GPR signal profile of T-160

Test Excavation 161

T-161 measured 0.9 m by 3.0 m and was oriented northeast to southwest and was located within a landscaped median 1.0 m south of Kanpai's front door, 18.0 m north of Halekauwila Street and Ward Avenue intersection. The GPR grid measured 1.0 m by 4.0 m with 0.25 m spacing between Y transects and 1.0 m spacing between X transects. Utilities located near the excavation include: telephone line 0.9 m southeast, sewer line 5.1 m southeast, water line 7.1 m southeast. No utilities transected the GPR grid or excavation location.

A review of amplitude slice maps indicated no linear features which might indicate the presence of utilities. Reflectivity was relatively uniform throughout the grid and decreased with depth. A transition from higher reflectivity to lower reflectivity was observed at approximately 0.5 mbs (Figure 107).

GPR depth profiles for T-161 identified horizontal banding, commonly associated with stratigraphic layering, throughout the survey area (Figure 108). This banding corresponded to variations of density and chemical composition within fill deposits. The profile also indicated a change in reflectivity that occurred around 0.2 mbs. No utilities were observed in the profile. The maximum depth of clean signal return was approximately 1.0 mbs.

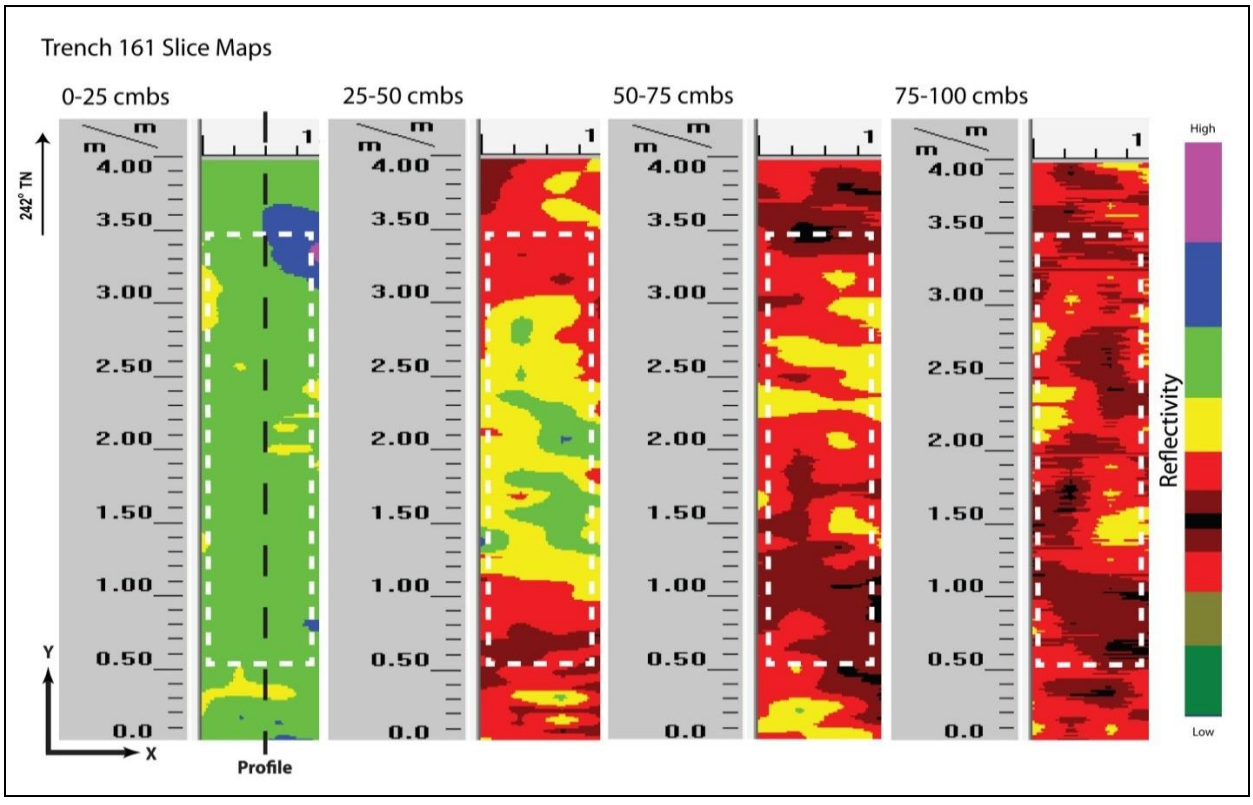

Figure 107. Slice maps of T-161 at 25cm depth intervals

A visual comparison of the excavated profile and the GPR signal profile showed a weak correlation in stratigraphic transitions (Figure 108). Strata included: silty clay loam fill, gravelly silty clay loam fill, very gravelly sand fill, natural silty clay, natural gravelly sandy clay loam, and natural sand. These transitions were not clearly depicted in the GPR profile at the depths that they occured. No other sediment transitions or discrete objects were observed in the GPR results or subsequent excavation.

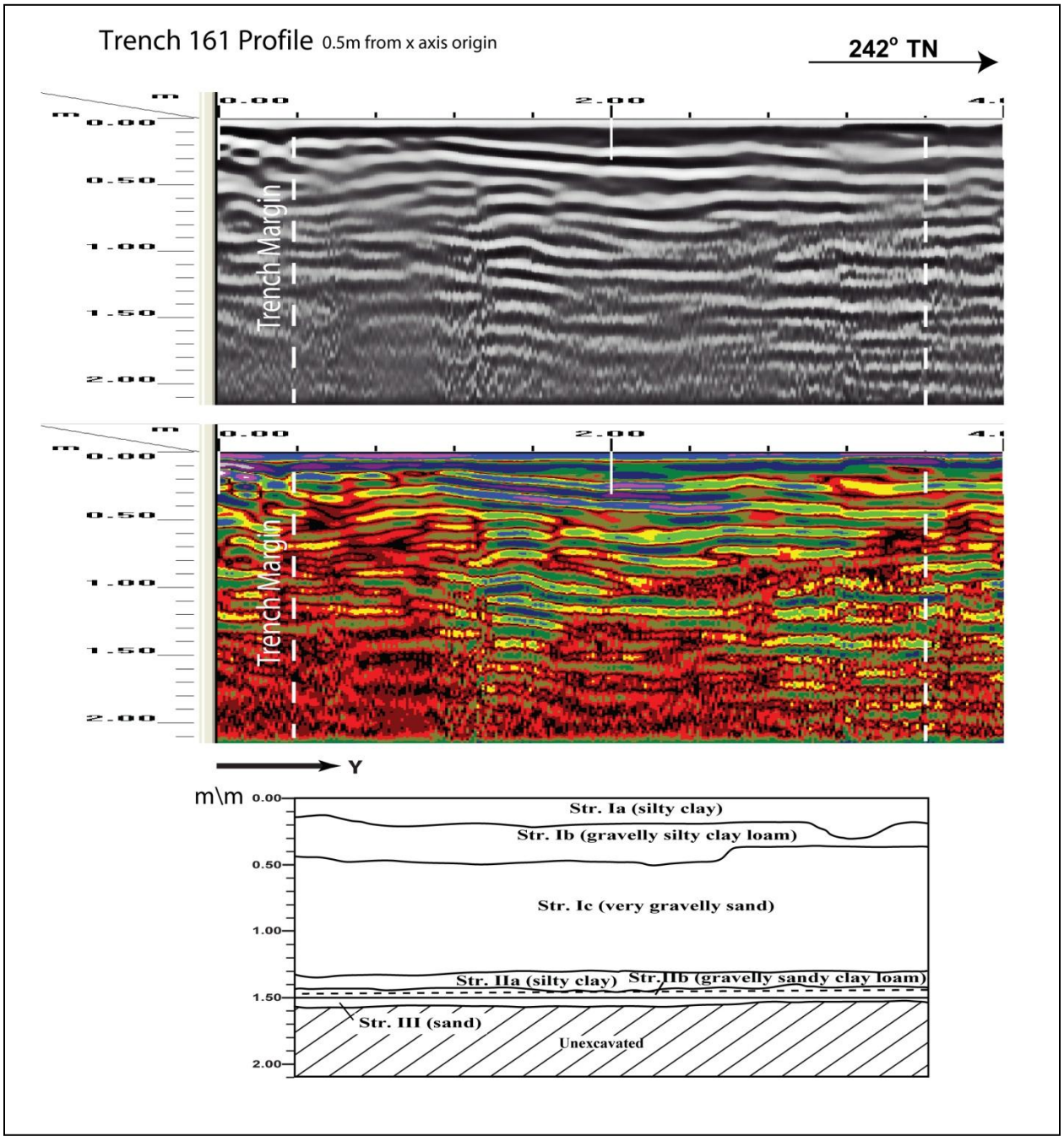

Figure 108. Visual comparison of excavated profile and GPR signal profile of T-161